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Quarterly

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INTERNATIONAL

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of the

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Wide World

On Oct. 21, five trailer trucks collided on the fog-shrouded Pennsylvania Turnpike near Greensburg and three caught fire. The driver of one of the trucks was trapped in the wreckage and burned to death, while valuable cargo in the trailers was totally consumed. This fire is symbolic of increasing fire record experience in automobile, truck and bus accidents which have contributed to the heavy toll of life occurring on our highways.

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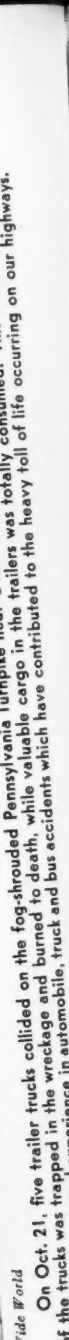

Wide World

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NFPA Service to Industry

"For more than 25 years the speaker has been a member of the Committee on Gases, during most of that time serving as its Chairman. These many years have afforded opportunity to note the steadily increasing interest of industry in NFPA activities, and also the influence of the NFPA on industry. Indeed, it is no exaggeration to say that the work of the NFPA has been a potent force in industrial growth. Any industry producing products which involve the use of materials and processes possessing inherent hazards can only grow and prosper if such hazards are properly safeguarded, and related municipal or state legislation is not unduly restrictive. This is the field in which the NFPA works for industry." These were the opening remarks by Chairman H. E. Newell of the NFPA Committee on Gases, speaking before the NFPA Northeastern Regional Meeting in Hartford on October 29.

Mr. Newell, who is Assistant Chief Engineer of the National Board of Fire Underwriters, has rendered outstanding service to the NFPA in various committee projects and has consistently kept in mind the importance to industry of proper fire safety standards. In his remarks before the meeting he reviewed the history of NFPA standards on acetylene house lighting which pointed the way towards the safeguarding of inherently hazardous installations, making the point that only through the observance of proper safeguards as established by the NFPA committee was the industry able to prosper and give satisfactory service.

Acetylene house lighting has now been outmoded, but Mr. Newell cited the more recent NFPA activities in the field of safeguarding liquefied petroleum gas as an even more outstanding example of service to industry. During the entire period of the development in the use of liquefied petroleum gas the industry has worked in close cooperation with the NFPA and frequent changes in NFPA standards have been made to keep them up to date. Now these NFPA standards as published by the Association in the National Fire Codes, Volume I, and by the National Board of Fire Underwriters in Pamphlet 58, are universally accepted by all concerned as the proper criterion for safe installations of liquefied petroleum gas equipment. These standards have been adopted as state law or are used as state fire marshals' regulations having the effect of law, in some 32 states.

Many other examples might be cited of NFPA service to industry. Such service is possible only through industry cooperation and support of the Association. Current developments in our technical committees point towards an increasing recog-

nition by industry of the value of proper standards developed by the NFPA and we hope that in the years to come we may enjoy an even greater degree of cooperation and support with consequent benefits to the industries concerned, to fire protection authorities, and to the general public.

Building Codes In these days of continuing housing shortages, frequent references are made to the need for bringing building codes up to date to facilitate the construction of buildings. Statements have been made that obsolete provisions of building codes serve often to impose unnecessary barriers to housing construction. A recent survey by the National Bureau of Standards covering 3,640 municipalities shows that 990 have no code whatsoever, 691 have codes 20 years or more old, and only 574 report codes adopted within the last five years.

Building codes are an instrument for the application of police power in the interest of public safety. Building codes are intended to assure construction that will be reasonably free from the danger of structural collapse, be reasonably safe from fire, and include proper provisions for health and sanitation. Judging by the relative frequency of fire and structural collapse, we must conclude that fire-safety is by far the more important factor in building codes and that even without any municipal regulation, few buildings would be erected which would be in imminent danger of structural collapse. It is not easy to measure the relative importance of building code provisions on health and sanitation features, but it seems reasonable to assume that public demands for comfort and convenience are such also as to assure at least some attention to those features of building construction which may affect public health, even in the absence of legal regulation. Thus to us fire safety seems by far the most important factor in building codes, but we feel that it has not received attention in proportion to its importance.

Many unthinking persons seem to feel that the adoption of a good modern building code is all that is needed to assure the fire safety of a city. All too frequently, even where there is a good building code, no adequate provision is made for its enforcement, there is lack of proper coordination between building and fire departments, and building inspection personnel does not receive either sufficient financial or moral support to do the kind of job which conscientious building inspectors know is needed. It must be recognized that a building code, no matter how detailed, cannot cover every possible contingency and that there must be considerable latitude for the exercise of engineering judgment in the application of building codes, particularly to large special purpose buildings which by their very nature cannot follow the ordinary pattern of conventional design.

At best, building codes can have a material effect upon the fire safety of old cities only after a long period of years. Few building codes have retroactive features, and those provisions which are retroactive are seldom applied except in cases of the most glaring hazards. Thus while new buildings erected under a modern building code may be safe, the great majority of our cities still consist of old buildings, many of which are not safe. And, if a building code is so stringent as to make new construction unduly expensive, the net effect is to discourage new buildings, perpetuate the older hazardous structures, and thus actually serve as a detriment to the fire safety

of a city. Thus there are difficult questions to decide as to how far a building code should go and no one should be under any illusions that a building code under any conditions can make a city safe within any short space of time.

The NFPA has not developed any model building code, although the Association publishes the Building Exits Code and many individual standards dealing with various features concerning the structure and fire protection equipment which are used as a basis for building code requirements. There are a number of model building codes in the field, all of which have their good features. The recommended building code of the National Board of Fire Underwriters is the longest established of these model codes. The Uniform Code of the Pacific Coast Building Officials Conference is used widely not only in the Pacific Coast area but in other parts of the country. The Southern Standard Building Code, prepared by the Southern Building Code Congress, is used to a considerable extent in the southern states. These codes are described in some detail and the differences between them are explained in the chapters on building construction in the tenth edition of the NFPA Handbook of Fire Protection.

A more recent building code activity is that of the Building Officials Conference of America, which is in process of developing a model code, the announced purpose of which is to provide performance requirements as distinguished from the specification type of building code, but which does not fully meet this objective.

Model codes and the many individual city codes which are independently prepared, are tending to an increasing extent to specify construction in terms of performance rather than in terms of individual structural materials. Thus under modern building codes it is to an increasing extent possible to use any desired material of construction if it meets performance specifications as to fire resistance. This permits flexibility of design and the use of new and more economical materials as they are developed.

The NFPA is participating in a series of building code committee projects under the procedure of the American Standards Association and is sponsor or joint sponsor for certain of these projects. This activity, which has been under way for about 15 years, is intended to provide various standards to be incorporated in building codes. Progress has been made in this activity and it is anticipated that as a result of current work in the Committee on Building Code Requirements for Fire Protection and Fire Resistance some standards dealing with building types, occupancy and other features will shortly be submitted to the NFPA as one of the joint sponsors for this particular project. One of the standards in the group which has been completed is entitled Administrative Requirements for Building Codes. This is intended to provide the machinery for implementing building code requirements. The NFPA representative has voted negatively on this particular standard because it makes no provision for the application of fire protection skill or experience in building code administration, which we think is of great importance. Skills and experience in features other than fire-safety are, however, specifically provided for.

The national building code picture is complicated, and those who are not intimately concerned with its details often find themselves confused. Many NFPA members are participating in various forms of building code activity, both in national

organizations and at state and local levels. All such activities are commendable and over a long period of years may have far-reaching effects in improving fire safety.

Life Hazards In Stores We can thank Divine Providence for having come through another Christmas season without a major loss of life fire in a store crowded with Christmas shoppers, for in some stores throughout the country the stage has been set for a fire tragedy that might have claimed hundreds, if not thousands, of lives. Stacks of highly combustible merchandise, wrapping and packing materials, combustible construction of many stores and combustible finish and partitions in other stores which are structurally fire resistive, provide quick burning fuel. In many stores, concealed spaces could harbor fire smoldering undetected until it broke out with explosive speed. Open stairs and other unprotected vertical openings provide draft flues to spread fire throughout the building.

In making these general statements, we do not intend any blanket indictment of store management. Many of the larger department stores, for example, are keenly conscious of the potential hazard to life and do all that they think they can to minimize life hazards. Yet despite these shining exceptions and the absence of any major store fire involving loss of life, the conclusion is inescapable that there is a serious hazard of loss of life by fire in many stores, large and small, throughout the country.

Automatic sprinklers, provided in the majority of the larger establishments, furnish most valuable protection which minimizes the danger of fire damage, assuming that the systems are properly maintained. However, they do not prevent all smoke, particularly where fire starts under a counter or in some other place where water from sprinklers cannot reach the seat of the fire. Sprinklers are credited with successful performance if they confine such a fire to its place of origin and prevent spread pending extinguishment of the shielded fire by manual means. However, in the interim a considerable amount of smoke may be released. And, in a crowd, it may take only a wisp of smoke and a hysterical cry of "Fire" to cause a fatal panic, even under conditions where there is no immediate fire danger. Further, in some stores the hazard may be intensified by air conditioning systems which, in the absence of safeguards recommended by NFPA standards, may spread smoke from a small fire throughout an entire building in a very short space of time.

Exits sufficient to permit the rapid evacuation of the building are obviously necessary in the interest of life safety. Panic conditions are not likely to develop where convenient and safe means of escape are available.

Exits are generally provided to comply with the local building code requirements when a store is built. However, exits are often not properly maintained or are not changed to keep pace with changes in the store, and in the great majority of cases, exits are not consistent either in letter or spirit with the provisions of the Building Exits Code, prepared by the NFPA Committee on Safety to Life. These comments apply primarily to large, multi-story buildings and to basement stores; there is relatively little danger to life in the small street floor store.

The merchandising genius of American store management has progressively made retail mercantile establishments more at-

tractive and has led more customers into every part of the building. If a small fraction of the amount of planning to get customers into stores had been directed towards planning for their rapid escape in case of emergency, the stores of America would be models of fire safety. As it is, in all too many cases, the customer may find it difficult to get out of the store by any route different from that followed to get in, and if the entrance way should be blocked by fire, the consequences might be disastrous. Displays, decorations and temporary partitions all too frequently block the way to emergency exits or effectively conceal them. The customer standing in the middle of a store often has no way of knowing which of several possible paths of travel leads to safety and which to a dead end enclosure. Exits are sometimes locked to prevent theft or improper use.

Fire insurance provides an economic incentive for the installation and proper maintenance of automatic sprinklers and for various measures for the control of fire hazards, but there is no immediate economic incentive for measures concerned solely with life safety from fire. Municipal inspection services, while exerting a powerful influence, cannot be expected to do much beyond the correction of the most glaring hazards, due to limitations of available inspection personnel and lack of sufficient public support.

It is a curious anachronism that theatres are so fully regulated, and that stores, which jeopardize more people, have gone relatively unnoticed in the establishment of safeguards against loss of life by fire. Must we have a major store holocaust and sacrifice hundreds of lives before the public demands that stores be made safe from fire?

Book Matches Safety matches are widely recommended by fire protection authorities in preference to "strike anywhere" or so-called kitchen matches. There is some reason to doubt, however, whether paper book matches, even though of the "safety" type, actually afford the advantages that have been claimed for safety matches. Paper book matches, like other products, vary in quality, but from the point of view of fire hazard are naturally judged by the poorest product, in the absence of any convenient method by which the general public can differentiate between products of different hazard.

We frequently hear of cases where the whole book is ignited when a match is struck, sometimes with painful burns to the user. Such cases are not necessarily limited to instances where the user fails to heed the admonition to close the cover before striking, as heads can break and fly. A number of cases have been reported where paper matches ignited in pockets due to carrying two books together, the striking surface of one book accidentally rubbing against the match heads in the other. The placing of the striking surface on the reverse of the book, away from the matches, seems to be a desirable practice, but by no means eliminates all hazard. There is no way of determining the extent to which paper book matches, as compared with other matches, are responsible for fires, but we know that the U. S. Post Office Department, as a result of mysterious fires in mail matter, last year issued regulations prohibiting mail shipments of book matches except in carefully specified safe shipping containers. Such matches had previously been extensively mailed for advertising purposes.

A new use of book matches for advertising purposes, involving considerable hazard, has recently been reported from Woodbury, New Jersey. There, book matches were thrown from a commercial float in a Hallowe'en parade. Small children among the spectators at once began lighting the matches, often in close proximity to crepe paper costumes worn by some of the children. Fortunately, no fire occurred, but some of the local people were so concerned that a movement is under way for a New Jersey law to bar such distribution of matches.

The Spirit of Independence The American spirit of independence may be a more important factor in our bad record of loss of life and destruction of property by fire than is commonly realized, and the following story is given as a case in point. A short time after the Hartford circus disaster, the progressive fire officials of Los Angeles, Chief John H. Alderson and Fire Marshal Henry R. Boone, sent a letter to all circuses throughout the country telling them of certain simple safety measures that they would have to take before their circus would be allowed to play in the city. Shortly after this letter went out, these men received a letter from a lady owner of one of the large circuses with headquarters in Texas which read as follows:

"Gentlemen: In reply to your letter, will say you must be having hallucinations to dream of my show playing Los Angeles.

"In the first place, I don't believe in dictators so I don't intend to allow my circus to show in a city where they dictate as to seats, foot rests, etc. I did not get this circus by allowing people to tell me how to run it or arrange it.

"I have the second largest circus in America and the only five-ring circus, also the largest tent.

"However, rest assured, gentlemen, if and when I do see fit to bring my circus to Los Angeles, Calif., I shall have a rocking chair for each and every patron, plus an individual electric fan, plus an air-cushioned footrest.

"Why should any circus want to play your city when it is known throughout the United States that there are more nonsensical rules and regulations governing a circus in your city than in any other ten cities put together?"

Perhaps this provides some indication of the difficulties that our fire chiefs and fire marshals are faced with when they try to protect the public against the hazards of fire.

Fire Protection Developments in 1948

By Percy Bugbee, General Manager,
National Fire Protection Association

Preliminary estimates of the fire loss for 1948 stand at $725,000,000. This is an increase of approximately 3 per cent over the comparable 1947 estimate. This is the highest fire loss in dollars ever recorded in the United States but, of course, it must be remembered that we are in an inflationary period and it may well be that in relation to the total amount of burnable values we are probably not burning up any more actual property relatively than in some other years. There is nothing, however, in these figures to make anyone feel at all complacent.

It is too early to arrive at any satisfactory estimates as to the number of outbreaks of fires, but all of the indications point to the fact that numbers of fires have been increasing.

The year 1948 has been a year of large and disastrous fires. The NFPA Fire Record Department estimates that there were 33 fires in the United States and Canada during the past year causing individual losses of $1,000,000 or more and 235 other fires where the damage exceeded the quarter million mark. These 268 large fires compare with 202 in 1947 and these fires alone caused approximately 18 per cent of the total fire loss sustained. The lessons taught by these large fires are not new. Protection of vertical and horizontal openings so that the area subject to a single fire is limited, installation of automatic detection and extinguishing equipment, organization of industrial and mercantile fire brigades, and strong and well-trained municipal fire departments are by and large the answer.

It is regrettable but true that adequate statistics on deaths and injuries in fires are not at present available from any source. It is to be hoped that the new NFPA Committee on Fire Casualty Statistics can lead the way to an improvement in this area. However, again all indications point to the fact that deaths and injuries in fires have been on the increase in recent years and it is quite probable that our present estimate of approximately 11,000 deaths from fire in the United States annually is conservative.

State Conferences

The impetus to fire prevention created by President Truman's Conference on Fire Prevention which was held in Washington in 1947 continued to a considerable degree throughout 1948. The recommendations coming out of the President's Conference were transferred by the Conference to the states and cities. During 1948 state conferences sponsored by the governors in each instance were held in Alabama, Colorado, Connecticut, Florida, Georgia, Illinois, Iowa, Maine, Maryland, Minnesota, Ohio, Rhode Island, Tennessee and Virginia. Also in the states of California, Michigan, Nevada, New Mexico, Oklahoma and Utah state fire advisory boards were created by the governors. Of all of these state fire prevention efforts that in Ohio appears to have the most promise for year-round effectiveness. It seems probable that some of these worth-while

state programs will not have long vitality, but it is to be hoped that in a number of states the good work started will continue.

Civil Defense

The question of planning for civil defense in the event of another world war and a possible attack upon our own country is of interest to all students of fire protection because of the devastating role that fire played as a weapon in World War II. The subject of civil defense planning appears to be of real interest to state and municipal officials, but the American public at large appears to be indifferent and uninterested. The report entitled "Civil Defense for National Security" prepared by the U. S. Office of Civil Defense Planning for Secretary of Defense Forrestal appeared late in 1948 and the next step, so far as federal interest in civil defense planning is concerned, appears to be up to the 81st Congress. The sections of this report dealing with fire were largely the work of Chief Frank McAuliffe of the Chicago Insurance Patrols, President of the International Association of Fire Chiefs, assisted by a panel of eight fire chiefs and 13 other fire experts. The report recommends a fire service division in the federal Office of Civil Defense, a state fire services division under a state civil defense director in each state, and a local fire service division for civil defense in each locality under the direction of the fire chief. In general, the responsibility is transferred to the individual states and cities and away from the military.

Fire Departments

Generally rising city costs affect all branches of city government, including the municipal fire departments. There is a discernible trend, and probably a most desirable one, of measuring the efficiency of a municipal fire department in terms of results and not just in terms of size. The fire chief who can demonstrate results in reduced losses and reduced fire hazards in his city will not have to worry very much about support from the taxpayers. The importance of fire prevention work in fire departments has too long been overlooked. The fire prevention work carried on by a fire department has received all too inadequate a share of the fire department budget. There are still too many cities that look upon the fire prevention division as a sort of stepchild or as a dumping ground for men who would otherwise be put on the pension rolls.

The modern trend of reducing the actual working hours of all classes of labor is being felt in the fire service more strongly than ever before. The 48-hour week for firemen continues to have its appeal to the voter, who does not recognize that such a provision requires the employment of greater numbers of firemen, increasing the cost of fire department operation to a substantial degree. The city administration is thus faced with a choice of either a reduction in the available manpower on duty at any one time or a corresponding increase in personnel, which must be paid for by augmenting municipal revenues. It should also be observed that the trend to shorter hours makes it more difficult for the firemen to secure pay increases, so that the securing of the 48-hour week for firemen may not be an unmixed blessing to the men.

The acute shortages of fire apparatus experienced during and after the war have eased to some extent. Municipal fire apparatus has been more readily obtainable, but like everything else has become more expensive.

The progressive trends in fire department training have continued throughout

1948. An estimated 35,000 firemen participated in courses affiliated with firemen's training programs in some 35 states which reported their training activities on a state-wide basis. Of course, many additional thousands of firemen, both paid and volunteer, participated in training work in individual departments by instructors trained through the state programs. Today in most states the training programs, whether given by an itinerant instructor, by a local instructor trained at a state-sponsored training course, or given at a central fire training school, consist of measured systematic instruction.

A rather unusual but nevertheless well-deserved tribute to the thousands of volunteer firemen in the United States was provided in 1948 by the issuance of a new United States postage stamp commemorating the 300th anniversary of organized volunteer fire service.

Legislation

Throughout 1948 the interest developed in 1947 in adequate measures for hotel fire safety was maintained. A number of state laws and a considerable number of local ordinances regulating hotel safety were enacted during the year and some cities such as Hartford, Conn., secured proper interior fire protection in all their hotels. A new edition of the NFPA Building Exits Code, a code widely used in states and cities, appeared in 1948. The State of Georgia adopted the NFPA Building Exits Code as law. The State of Virginia is undertaking a revision of its laws governing fire protection in buildings and is taking steps to provide a number of changes in various state standards for fire protection. Similar action is also under way or completed in Ohio and New Hampshire. In its comparatively new State Division of Safety New York State has created a Bureau of Fire Mobilization and Control. Fire officials in port cities were interested and encouraged by a case in Los Angeles Harbor which provided an important precedent for the enforcement of local fire regulations governing the safe handling of hazardous cargoes. In this case failure to follow local harbor regulations resulted in a large oil spill and a serious fire hazard. The ship's captain and second mate were fined $250 each in municipal court and the cost of clean-up estimated at $9,000 was charged against the ship.

There is a slowly growing recognition that careless smokers are responsible for altogether too many fires, and local ordinances designed to prohibit smoking or to penalize the careless smoker in theatres, department stores, hotel bedrooms, etc., have been adopted in numerous cities during 1948. The largest city to take such action was Chicago, late in the year.

New Hazards

New hazards that caused considerable interest during the year were the introduction of self-service gasoline stations and the widespread development of television. Various types of self-service gasoline stations have been tried out, some with obviously more fire hazard than others, and action has been taken by some states and cities to prohibit self-service gasoline stations. The growth of this movement is yet to be determined and the fire hazard aspects have not yet been clearly defined. Further experience and investigation during the coming year will bring a clearer answer to this problem. In the case of television, the development is still too new and experience too meagre to make any final observations as to its importance as a fire hazard. A good many city building officials have been concerned about the erection of television antennae, with a

consequent increase in possible accident and lightning hazard. The subject is now under active consideration by the NFPA Electrical Section.

Fire Prevention Education

It is with great satisfaction that we can say there is a growing interest in fire prevention education not only of workers, housewives and other adults, but of children. The demand for educational material on common fire hazards is growing very markedly. The interest of the United States Office of Education and of the National Education Association in fire prevention education in the schools is most welcome. A highlight of the NFPA annual meeting in Washington last spring was the forum on fire prevention education conducted by leaders in the field. The junior fire brigade development as exemplified in Los Angeles and Dallas is attracting great interest and will undoubtedly spread to many other cities.

The perennial popularity of Fire Prevention Week as a device to stimulate public interest in fire prevention increases year after year. In the Fire Prevention Week competition among cities sponsored by the NFPA, entries were received from 2928 cities, the largest number ever enrolled. The top 10 cities in the United States in the order of their final grade were Oak Ridge, Tenn., Memphis, Tenn., Chicago, Ill., Jersey City, N. J., Louisville, Ky., Fort Collins, Colo., Hartford, Conn., Los Alamos, N. M., Anderson, Ind., and Fort Wayne, Ind. Ottawa, Ontario, was the winner in Canada.

Winners in the National Fire Waste Council Contest for year-round excellence in fire prevention activities for 1947 were Chicago, Atlanta, Tulsa, Alameda, Calif., Parkersburg, W. Va., and Fort Collins, Colo., with Fort Collins emerging as the grand winner.

Nineteen forty-eight was a banner year for the National Fire Protection Association and all previous records for membership and output of publications were broken. The year was marked by the issuance of the tenth edition of the Handbook of Fire Protection, without question the most widely accepted reference document in the field of fire protection engineering in the world. During the year also a new Electrical Section was created by the NFPA and a complete revision of the machinery for producing subsequent editions of the National Electrical Code was effected. The first regional meeting of the Association was successfully carried out in Hartford, Conn., in October.

Large Loss Fires of 1948

A Staff Study

The year 1948 had the worst fire record in U. S. and Canadian history. Major fire disasters also occurred in other parts of the world — in Chile, China, France, Germany, Great Britain, Holland, Ireland, Mexico, and elsewhere.* Unfortunately, figures are not available to assess world fire loss experience.

Because we can secure some valuable clues from a study of the largest of these fires to aid in our future fire prevention and protection work this analysis has been made of all U. S. and Canadian fires having individual losses in excess of $250,000.

Since information available to the Association is chiefly confined to North American fire experience, our analysis has been concentrated on the fires occurring within this geographical area. Never before has North America suffered so many fires above the $250,000 mark. Even in 1946 and 1947 when we had the tragic disasters of the La Salle and Winecoff Hotels and, worst of all, Texas City, there were not so many separate fires involving property damages of this magnitude. The trend has been consistently "up" since the NFPA initiated this annual study of large loss fires in 1931, but has been particularly alarming in the past three years. In 1946 there were 187 major fires, in 1947, 202, and last year, 268. The total estimated dollar loss from 1948's 268 fires is $141,497,000, about 18% of the estimated aggregate fire loss in the United States and Canada ($800,000,000). It may be safely estimated, at the same time, that these 268 fires which caused just less than one-fifth the total fire loss represent only about four hundredths of one per cent of the total number of fires that occurred. Thus, by concentrating on these major fires we can achieve maximum results in terms of fire waste reduction.

*See page 198.

Acknowledgment

It is only possible for the NFPA to present this study because of the loyal support of its members who have supplied, without financial remuneration, reports on major fires occurring in their localities. Our appreciation for their help is most sincere.

Many fires reported in the press at the time they occurred as involving losses in excess of $250,000 are not included in this article. Over 150 such fires have been eliminated based on revised estimates supported by authenticated subsequent data. Other losses, originally reported less than $250,000, have been included because of later upward revision.

Since this type of study is planned as an annual feature of our January QUARTERLY, all NFPA members and readers are urged to volunteer reports on fires about which they have information.

Table No. I

PRINCIPAL OCCUPANCY BREAKDOWN

	No. of Fires by Years		
	1948	1947	1946
Manufacturing	92	64	58
Miscellaneous	59	39	30
Warehouse	52	45	44
Mercantile	36	26	24
Transportation	20	22	20
Habitational	9	6	11
Totals	268	202	187

While it is quite true that by far the largest proportion of our fire casualties occur in small dwelling fires, 224 persons were killed in the 268 fires analyzed in this article. This is about 2% of the total

estimated fire deaths in the United States last year (11,000). Much remains to be done in this connection, but attention to the fatal fires included in this group will afford a major opportunity to reduce the unnecessary toll of life taken by fire annually.

Tables

Table No. 1 compares the number of fires in each of the principal occupancy breakdowns during the past three years. Further information on each grouping will be found on pages 149, 157, 167, 173, 179, and 183. In the other tables, the reader will be able to analyze pertinent facts by these same occupancy divisions for application to his field of interest.

Table No. 2 provides basic data on the subject of automatic sprinkler protection. It will be noted that 206 of the properties involved lacked either complete or partial sprinkler protection. This is very nearly 90%. Reasons for the unsatisfactory fire experience in the sprinklered properties affected are given in Table No. 19.

Major fires seldom produce worthwhile statistics on fire causes and no attempt is made in this article to draw conclusions from those few fires where cause is known other than to classify them as to "common" and "special" hazard causes, incendiary fires, or "unknown." (See Table No. 3.) The fact that in 60% of the fires, cause could not be determined is evidence enough as to why "cause" studies of major fires are not conclusive. It may be interesting to record the fact that in the fires of known cause (total 88), it appeared that 58 could have been prevented by the provision of proper fire prevention safeguards and the balance, 30, by education to prevent human carelessness.

The other tables which follow are designed to provide the reader with the clearest possible information on other important factors extracted from the NFPA staff study of the 268 fires. Following the pictorial presentation, each fire included is listed by occupancy and date for the convenience of the reader.

Table No. 2

AUTOMATIC SPRINKLER PROTECTION

(excludes transportation category fires—aircraft, ship and railway cars)

	Manufacturing	Miscellaneous	Warehouse	Mercantile	Habitational	Totals
No automatic sprinkler protection	68	46	49	34	9	206
Complete automatic sprinkler protection	16	0	2	0	0	18
Partial automatic sprinkler protection	3	1	1	2	0	7
Automatic sprinkler protection not applicable to hazard	5	12	0	0	0	17
Totals	92	59	52	36	9	248

Table No. 3

CAUSES OF FIRES

(excludes transportation category fires)

	Manufacturing	Miscellaneous	Warehouse	Mercantile	Habitational	Totals
Common hazard	13	17	11	8	2	51
Special hazard	26	6	5	0	0	37
Fire purposely set	0	6	2	0	1	9
Unknown	53	30	34	28	6	151
Totals	**92**	**59**	**52**	**36**	**9**	**248**

Table No. 4

FIRE CASUALTY STATISTICS

Deaths	Manufacturing	Miscellaneous	Warehouse	Mercantile	Transportation	Habitational	Totals
Occupants	61	2	2	2	141	12	220
Firemen	0	1	0	3	0	0	4
Totals	61	3	2	5	141	12	224
Injuries							
Occupants	134	37	15	4	61	20	271
Firemen	155	92	26	69	0	10	352
Outsider	0	0	1	0	0	0	1
Totals	289	129	42	73	61	30	624

Table No. 5

CHRONOLOGICAL ORDER

	Total		Total
January	31	August	17
February	31	September	23
March	24	October	16
April	22	November	19
May	21	December	23
June	23		
July	18	Total	268

Table No. 6

LOCATION

	Manufacturing	Miscellaneous	Warehouse	Mercantile	Transportation	Habitational	Totals No.	Totals %
Within city limits	74	43	48	35	6*	8	214	80.0
Just outside city	6	8	2	0	7*	0	23	8.5
Other outside area	10	7	2	1	1*	1	22	8.0
Government reservation	2	1	0	0	5*	0	8	3.0
At sea	0	0	0	0	1	0	1	0.5
Totals	92	59	52	36	20	9	268	100.0

*Re aircraft, location given is location of ground impact.

Table No. 7

POPULATION

	Manufacturing	Miscellaneous	Warehouse	Mercantile	Transportation	Habitational	Totals No.	Totals %
0-500	4	3	1	0	2	3	13	4.9
501-1,000	3	3	1	0	0	0	7	2.6
1,001-5,000	17	8	3	5	0	0	33	12.3
5,001-10,000	7	4	2	3	0	2	18	6.7
10,001-20,000	6	6	4	7	0	1	24	9.0
20,001-50,000	9	3	6	2	0	0	20	7.5
50,001-100,000	1	3	2	4	0	2	12	4.5
Over 100,000	27	13	29	14	4	0	87	32.5
Just outside city	6	8	2	0	7	0	23	8.6
Other outside area	10	7	2	1	1	1	22	8.2
Government reservation	2	1	0	0	5	0	8	2.8
At sea	0	0	0	0	1	0	1	0.4
Totals	92	59	52	36	20	9	268	100.0

Table No. 8

GEOGRAPHIC DISTRIBUTION

	Totals
New England	
Maine	1
New Hampshire	1
Vermont	1
Massachusetts	13
Rhode Island	1
Connecticut	1
Sub-total	18
Middle Atlantic	
New York	19
New Jersey	14
Pennsylvania	14
Sub-total	47
East North Central	
Ohio	16
Indiana	6
Illinois	13
Michigan	16
Wisconsin	5
Sub-total	56
West North Central	
Minnesota	5
Iowa	5
Missouri	7
North Dakota	0
South Dakota	2
Nebraska	2
Kansas	2
Sub-total	23
South Atlantic	
Delaware	1
Maryland	2
District of Columbia	1
Virginia	1
West Virginia	1
North Carolina	4
South Carolina	0
Georgia	2
Florida	7
Sub-total	19

	Totals
East South Central	
Kentucky	7
Tennessee	2
Alabama	2
Mississippi	4
Sub-total	15
West South Central	
Arkansas	3
Louisiana	2
Oklahoma	2
Texas	8
Sub-total	15
Mountain	
Montana	2
Idaho	3
Wyoming	2
Colorado	5
New Mexico	2
Arizona	1
Utah	0
Nevada	0
Sub-total	15
Pacific	
Washington	3
Oregon	1
California	26
Sub-total	30
Others	
Alaska	4
Atlantic Ocean (at sea)	1
Hawaii	1
Sub-total	6
Canada	
Alberta	3
British Columbia	4
Ontario	5
Quebec	12
Sub-total	24
Grand total	268

Table No. 9

TIME OF DAY

	Manufacturing	Miscellaneous	Warehouse	Mercantile	Transportation	Habitational	Totals
6:00 P.M. to 6:00 A.M.	56.5%	50.8%	59.6%	63.9%	45.0%	66.7%	56.3%
6:00 A.M. to 6:00 P.M.	41.3	45.8	40.4	36.1	35.0	33.3	40.7
Unknown	2.2	3.4	—	—	20.0	—	3.0

Table No. 10

OPERATING STATUS AT TIME OF FIRE

(excludes transportation category fires)

	Manufacturing	Miscellaneous	Warehouse	Mercantile	Habitational	Totals
Operating	52.2%	37.3%	26.9%	27.8%	33.3%	39.1%
Not operating	47.8	54.2	73.1	72.2	22.2	57.2
Under construction	—	1.7	—	—	—	0.5
Occupants asleep	—	—	—	—	44.5	1.6
Does not apply	—	6.8	—	—	—	1.6

Table No. 11

DETECTION

(excludes transportation category fires)

	Manufacturing	Miscellaneous	Warehouse	Mercantile	Habitational	Totals
Occupant (employee)	45	23	15	9	6	98
Outsider (passer-by)	23	22	20	21	2	88
Watchman (private)	13	7	9	3	1	33
Explosion	5	4	1	0	0	10
Police (public)	2	1	1	1	0	5
Observed by fire department	0	0	1	2	0	3
Automatic fire detection system (central station)	1	0	1	0	0	2
Automatic sprinkler system alarms	2	0	0	0	0	2
Burglar alarm	0	0	1	0	0	1
Unknown	1	2	3	0	0	6
Totals	92	59	52	36	9	248

Table No. 12

ALARM TRANSMISSION

(excludes transportation category fires)

	Manufacturing	Miscellaneous	Warehouse	Mercantile	Habitational	Totals
Telephone	55	35	31	23	9	153
Street fire alarm box	15	8	7	8	0	38
Private fire alarm box	7	2	3	0	0	12
Reported to fire department in person	1	4	3	1	0	9
Siren (private)	6	1	1	0	0	8
Police radio	1	1	2	1	0	5
Observed by fire department	1	0	1	2	0	4
No alarm	2	1	0	0	0	3
Automatic fire detection system (central station)	1	0	1	0	0	2
Automatic sprinkler system (central station)	1	0	0	0	0	1
Taxicab radio	0	0	0	1	0	1
Explosion	0	1	0	0	0	1
Unknown	2	6	3	0	0	11
Totals	92	59	52	36	9	248

Table No. 13

PLACE OF ORIGIN OF FIRES

(excludes transportation category fires)

	Manufacturing	Miscellaneous	Warehouse	Mercantile	Habitational	Totals
One Story Buildings Without Basement						
Exposure	5	3	7	0	0	15
Ground floor	28	19	14	4	0	65
Attic or horizontal concealed space	2	0	0	0	0	2
Roof	0	0	1	0	0	1
Unknown	2	0	1	0	0	3
Sub-totals	37	22	23	4	0	86
One Story Buildings With Basement						
Exposure	1	0	1	0	0	2
Basement	3	3	0	1	0	7
Ground floor	2	2	3	1	0	8
Attic or horizontal concealed space	0	0	0	2	0	2
Unknown	0	1	0	0	0	1
Sub-totals	6	6	4	4	0	20
Multi-Story Buildings No Basement						
Exposure	1	0	0	0	0	1
Ground floor	2	2	0	2	0	6
Upper floor	1	1	0	0	0	2
Attic or horizontal concealed space	1	0	0	0	0	1
Sub-totals	5	3	0	2	0	10
Multi-Story Buildings With Basement						
Exposure	0	1	2	1	0	4
Basement	3	2	4	10	0	19
Ground floor	17	5	4	6	1	33
Upper floor	13	2	12	7	2	36
Attic or horizontal concealed space	0	3	0	1	2	6
Roof	2	3	0	1	2	8
Unknown	6	1	3	0	2	12
Sub-totals	41	17	25	26	9	118
Not a Building	3	11	0	0	0	14
Grand totals	92	59	52	36	9	248

Table No. 14

AREAS INVOLVED BY FIRES

(excludes transportation category fires)

	Manufacturing	Miscellaneous	Warehouse	Mercantile	Habitational	Totals
Confined to room of origin	1	0	0	0	0	1
Confined to floor of origin	0	0	3	1	0	4
Confined to initial fire area	0	0	1	0	0	1
Confined to building of origin	56	31	38	21	8	154
Spread outside the structure initially involved	32	17*	10	14	1	74
Outside fires	3	11	0	0	0	14
Totals	92	59	52	36	9	248

*Excludes forest fires.

Table No. 15

CONSTRUCTION DETAILS

(excludes transportation category fires)

Walls	Manufacturing	Miscellaneous	Warehouse	Mercantile	Habitational	Totals
Fire resistive	8	0	3	2	0	13
Noncombustible	2	3	1	0	0	6
Brick or masonry	40	25	29	26	9	129
Wood, metal-clad	11	0	3	0	0	14
Wood	19	15	9	5	0	48
Combination	7	4	7	2	0	20
Unknown	2	1	0	1	0	4
Not a building	3	11	0	0	0	14
Totals	92	59	52	36	9	248
Roof Framing						
Fire resistive	8	0	3	2	0	13
Noncombustible	13	6	9	1	0	29
Heavy timber	8	3	12	2	1	26
Wood joist	58	36	28	30	8	160
Unknown	2	3	0	1	0	6
Not a building	3	11	0	0	0	14
Totals	92	59	52	36	9	248
Roof Covering						
Concrete, tile, slate, etc.	12	7	3	2	2	26
Metal	18	5	7	2	0	32
Built-up roof covering	37	11	27	20	2	97
Composition shingle	15	17	12	10	1	55
Wood shingle	2	4	1	1	1	9
Other	0	1	1	0	0	2
Unknown	5	3	1	1	3	13
Not a building	3	11	0	0	0	14
Totals	92	59	52	36	9	248

Table No. 16*

HUMAN FACTORS INFLUENCING FIRE SPREAD

(excludes transportation category fires)

	Manufacturing	Miscellaneous	Warehouse	Mercantile	Habitational	Totals
Detection of fire delayed in absence of efficient automatic protection	43	33	32	25	9	142
Owner of property obviously neglected fire safety	52	15	29	9	0	105
Delayed transmission of alarm to fire department following detection	21	12	13	10	4	60
Occupants fight the fire, delay giving fire alarm	19	4	8	8	1	40
Worker safety-consciousness obviously lacking	7	5	4	1	1	18
Recurrent fire record of owner	9	2	1	4	0	16
Occupants investigate source of smoke or heat, delay giving alarm	7	2	1	1	1	12
Occupants fail to call the fire department	2	4	1	2	0	9

*In Tables No. 16, 17, 18, 19, and 20, more than one factor listed in Tables may apply to each fire.

Table No. 17

STRUCTURAL DEFICIENCIES INFLUENCING FIRE SPREAD

(excludes transportation category fires)

	Manufacturing	Miscellaneous	Warehouse	Mercantile	Habitational	Totals
Horizontal Spread						
Special hazard area not cut off	47	13	17	7	2	86
Unprotected ordinary sized doorways	30	10	14	5	0	59
Large undivided attic	4	11	1	7	4	27
Nonfirestopped concealed spaces	4	8	1	5	0	18
Unprotected stock conveyors and machinery shafts	13	0	5	0	0	18
Firewall ineffective	4	3	5	2	0	14
Wall collapse	5	1	3	5	0	14
Highly combustible interior wallboard	4	4	1	4	0	13
Parapet on firewall ineffective	2	2	2	5	0	11
Undivided basement	0	1	3	6	0	10
Unprotected oversized doorways	1	2	6	0	0	9
Poorly constructed firewall	1	2	2	1	0	6
Ordinary glass windows	4	0	2	0	0	6
Lack of parapet on firewall	1	2	1	0	0	4
Firewall collapse	0	1	2	1	0	4
Oily deposits on walls	1	0	3	0	0	4
Firewall damaged by explosion	3	0	1	0	0	4
Asphalt coated metal	1	1	0	0	0	2
Vertical Spread						
Open stairwells	29	17	15	24	7	92
Open elevator shafts	12	1	14	14	3	44
Nonfirestopped walls	5	7	3	8	1	24
Unprotected machinery shafts and pipe openings	14	0	3	0	4	21
Roof collapse	9	4	2	3	1	19
Floor collapse	1	0	2	2	0	5
Air conditioning equipment	0	2	0	1	0	3
Spread to Exposures						
Inadequate clearance	32	21	10	9	1	73
Inferior (combustible) construction	17	15	6	10	1	49
Ordinary glass windows	12	2	4	9	1	28
Wood shingle roofs	2	2	1	1	0	6
Grass hazard	3	2	1	0	0	6
Trash hazard	1	2	1	1	0	5

Table No. 18

CHARACTER OF CONTENTS INFLUENCING FIRE SPREAD

(excludes transportation category fires)

Flammable Liquids	Manufacturing	Miscellaneous	Warehouse	Mercantile	Habitational	Totals
Under 25° flash point	8	10	11	1	0	30
Between 26°-70° F.	6	3	3	1	0	13
Between 71°-200° F.	6	5	4	3	0	18
Over 200° F.	13	13	1	6	0	33
In drums, cans, etc.	16	6	6	7	0	35
In above ground enclosed tanks	7	9	1	0	0	17
In automobile tanks	1	4	7	0	0	12
In open dip tanks, etc.	6	0	0	1	0	7
In aircraft tanks	1	5	0	0	0	6
Ruptured pipe lines	3	1	0	0	0	4
Leak from underground tanks	1	1	0	0	0	2
Compressed Gases	6	1	1	0	0	8

Table No. 18 (Cont'd)

CHARACTER OF CONTENTS INFLUENCING FIRE SPREAD

(excludes transportation category fires)

	Manufacturing	Miscellaneous	Warehouse	Mercantile	Habitational	Totals
Natural Gas Line Rupture	1	3	1	0	0	5
Explosives or Ammunition	1	1	0	2	0	4
Ordinary Combustible Materials						
Heavy storage concentration in single fire area	32	11	46	21	0	110
Poor stock subdivision	18	6	23	7	0	54
Oil soaked materials	7	2	8	1	0	18
Burrowing fire in stock	3	0	7	0	0	10
Water swelling materials	1	1	6	0	0	8
Inadequate window clearance	0	0	5	1	0	6
Inadequate wall clearance	0	1	3	0	0	4
Stock not skidded	2	0	2	0	0	4
Inadequate clearance from sprinklers	2	0	0	0	0	2
Housekeeping Conditions						
Poor housekeeping conditions	30	0	11	3	0	44
Bad dust conditions	23	0	6	0	0	29
Grains, Flour, Powdered Materials	7	1	7	0	0	15
Other Hazardous Materials	3	3	2	2	0	10
Records Not Safeguarded						
No fire resistive containers	8	4	2	1	1	16
Safe not fire resistive or open	0	1	1	1	0	3

A. E. Jones

This new noncombustible building in Monroe, Mich., was occupied for the storage of waste paper before the sprinkler installation had been completed.

Table No. 19

PRIVATE PROTECTION DEFICIENCIES INFLUENCING FIRE SPREAD

(excludes transportation category fires)

	Manufacturing	Miscellaneous	Warehouse	Mercantile	Habitational	Totals
Automatic Sprinklers						
No sprinkler protection	68	46	49	34	9	206
Hazard excessive for system	11	0	1	0	0	12
Insufficient water supply	8	0	1	0	0	9
Incomplete protection (fire origin in unsprinklered area)	3	1	1	2	0	7
Roof collapse ruptured piping	4	0	1	1	0	6
Deficient public water supply	6	0	0	0	0	6
Single water supply inadequate	4	0	1	0	0	5
Poor sprinkler maintenance	4	0	0	0	0	4
Deficient private water supply	3	0	0	0	0	3
Deficient sprinkler engineering	3	0	0	0	0	3
Explosion wrecked system	3	0	0	0	0	3
Fire department connection not used	3	0	0	0	0	3
Exposure fire to sprinklered building	2	1	0	0	0	3
Fire originally shielded from sprinkler discharge	3	0	0	0	0	3
Sprinkler supply pump failure	2	0	0	0	0	2
Water shut off prematurely	2	0	0	0	0	2
Lack of central station supervision responsible for delayed alarm	2	0	0	0	0	2
Other miscellaneous deficiencies noted	11	1	2	1	0	15
Automatic Detection Equipment (only nonoperating plants analyzed*)						
Lack of detection equipment delayed alarms	36	28	36	26	6	132
Improper type thermostat delayed alarm	0	0	1	0	0	1
Watchman Service (only nonoperating plants analyzed)						
Lack of watchman service delayed alarms	18	17	21	20	1	77
Nonstandard watchman service a factor in delayed alarms†	11	9	8	4	1	33
Watchman failure (performance in emergency not efficient)	12	5	11	3	0	31
Fire Brigade						
Needed, not available	12	4	6	0	5	27
First Aid Equipment						
Fire not controlled by the extinguishers used	16	7	7	4	2	36
Special extinguishing systems not available	6	1	1	0	0	8
Insufficient extinguishers	0	0	3	1	0	4
Special extinguishing system not effective	2	1	0	0	0	3
Standpipe hose not effective	2	1	0	0	0	3
Improper use of extinguishers	2	0	0	0	0	2
Yard Hydrant Systems						
Defective or deficient	4	0	2	0	0	6

*The lack of automatic detection equipment also delayed alarms in many fires occurring during operating periods, but the number could not be accurately checked because of the variances in fire reporting.

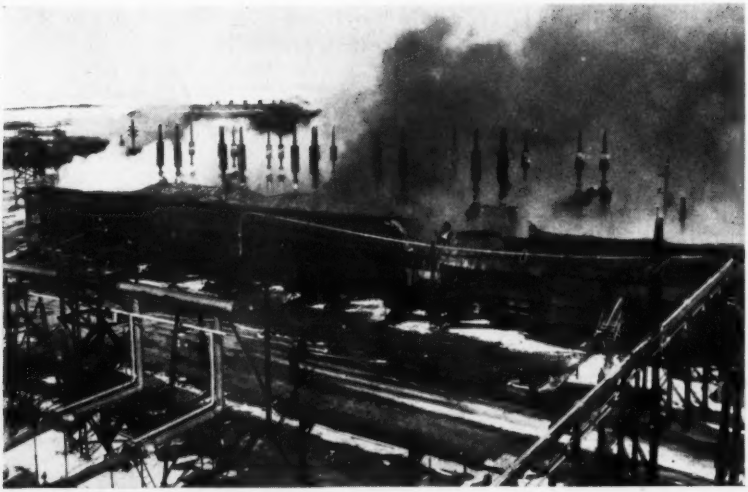
†Standard watchman service provided in 31 plants.

Table No. 20

PUBLIC PROTECTION AND FIRE FIGHTING HANDICAPS CONTRIBUTING TO FIRE SPREAD

(excludes transportation category fires)

	Manufacturing	Miscellaneous	Warehouse	Mercantile	Habitational	Totals
Fire Department Equipment						
Local F.D. required mutual aid	24	17	10	8	5	64
Insufficient fire equipment	26	13	6	8	5	58
No fire department locally available	12	8	2	0	2	24
No local F.D., outside F.D. called	9	3	1	0	0	13
Mutual aid not effective	5	1	0	4	2	12
Lack of aerial ladders	2	1	3	2	2	10
Equipment breakdown	2	2	0	0	0	4
Mutual aid needed, not available	0	1	1	1	0	3
Lack of oxygen mask	2	0	0	1	0	3
Fire Department Manpower and Training						
Insufficient manpower	25	13	4	10	4	56
Poor fire fighting	8	3	1	3	1	16
F.D. not familiar with property	8	2	0	0	0	10
Fire Department Response to Alarm						
Delayed response	16	4	4	1	0	25
Running distance long	10	7	4	0	1	22
Traffic congestion	6	0	0	0	0	6
Fire department at another fire	1	1	2	1	0	5
Railroad crossing slowed response	3	1	0	0	0	4
Spectators interfere	2	0	0	1	0	3
Weather Conditions						
High or adverse winds	21	14	11	4	3	53
Extreme cold	9	4	8	5	4	30
Snow or ice	0	2	2	1	2	7
Extreme drought	1	2	0	0	0	3
Character of Fire Behavior						
Explosion during fire	20	11	8	7	0	46
Heavy smoke	6	1	2	8	0	17
Explosion preceded fire	9	4	1	0	0	14
Explosion at start of fire	8	5	1	0	0	14
Character of Building or Area Affected						
Congested area handicapped access	7	0	3	4	0	14
Inadequate distance from exposure	2	8	1	2	0	13
No heat and smoke venting facilities	5	3	3	1	0	12
Explosion vents not provided	8	2	0	1	0	11
Blank walls handicapped access	2	2	3	1	0	8
Lack of proper city zoning	1	2	1	2	0	6
Leaking gas mains or pipes	2	3	1	0	0	6
Lack of proper diking (flam. liquids)	2	3	0	0	0	5
No exterior entrance to basement	0	1	1	2	0	4
Electric wires down, handicapped access	2	1	1	0	0	4
Barred windows handicapped access	0	0	2	2	0	4
Locked doors handicapped access	1	0	2	1	0	4
Railroad tracks handicapped access	2	0	0	2	0	4
Water Supplies						
Inadequate water for hose streams	23	18	12	6	5	64
Low water pressures	23	11	6	4	3	47
Undersized water mains	21	10	6	4	3	44
Inadequate hydrants	20	10	8	0	4	42
No water supply designed for fire protection	10	6	3	0	1	20
Inadequate water supply for automatic sprinklers and hose streams	8	0	1	0	0	9
Hydrants too close to building	5	3	0	0	0	8
Long hose lays required	4	1	3	0	0	8
Static source not available	4	3	0	0	0	7
Hydrants frozen	3	0	0	0	0	3



Autry Studio

March 6, near Etter, Texas. Fire involving escaping gas might have been extinguished with minor damage at the Cactus Ordnance Works had not asphalt-covered metal siding and roofing been ignited. The 450 ft. building, lacking fire division, was heavily damaged and expensive machinery ruined, with the loss estimated at $1,100,000. (See July 1949 Quarterly, page 56.)

Acme

Feb. 6, No. Philadelphia, Pa. Fire had complete possession of the main buildings of the Globe Solvent Co. when firemen arrived. Volatile liquids carried on water from hose streams endangered firemen. Minor explosions from drums and one heavy explosion from a large aboveground tank containing solvent complicated suppression efforts.

MANUFACTURING

28 Metalworking Plants
18 Food and Food Products Plants
16 Woodworking Plants
7 Chemical Plants
5 Textile Workers
4 Paper Products Plants
3 Brick, Tile and Stoneworking
2 Gas Works
2 Multiple Occupancy Manufacturing Plants
1 Electrical Generating Plant
1 Glass Products Plant
1 Hair Works
1 Plastic Plant
1 Printing Plant
1 Radio and Radio Equipment
1 Rubber Worker

92 Total

This group is the largest in point of number (92) and in dollar loss $49,967,500), and second in fatalities (61 persons). There were 13 fires in manufacturing plants causing individual losses of $1,000,000 or more.

The most severe manufacturing plant fire was the Brach and Sons Candy Co. loss of September 7 at Chicago, where 17 were killed and loss was estimated at $5,000,000 (including business interruption insurance values). This disaster was predominantly caused by starch dust explosions. In 22 other fires in manufacturing plants, dust contributed to fire spread.

This year's fire record reveals that of the 92 manufacturing plants destroyed in these major fires, 51% were in towns having under 10,000 population (31 cases) or outside city limits and in unincorporated localities (16 cases). In these locations, where public fire protection was either totally unavailable or not suitable for industrial plant fire defense, 84% of the properties were not protected by any form of automatic protection.

The 16 large losses in completely sprinklered manufacturing plants and 3 others in partially sprinklered structures are an increase over previous numbers. Reference is made to Table No. 19, page 146, and to the article appearing in this issue of the QUARTERLY, page 205, entitled "Why Unsatisfactory Sprinkler Fires?"

There was no evidence of intentional arson affecting manufacturing plants, although owner neglect for fire safety was present in 56% of the cases.

Delayed detection occurred in 47% of the fires, influenced by the fact that in a like percentage, fire occurred while the plant was *not* operating.

Delayed transmission of the fire alarm was manifest in about 23% of the cases, mostly occasioned by the tendency of employees and watchmen to fight the fire with hand extinguishers *before* calling the Fire Department.

Horizontal fire spread was affected by lack of fire division walls to segregate special hazard areas in 50% of the fires, by unprotected ordinary doorways in fire walls in 32.6% of the cases and by unprotected stock conveyors, machinery shafts, etc. in 14%.

Vertical fire spread in the 45 multistory industrial plants involved was influenced by failure to enclose stairwells (67.4%), machinery shafts (32.6%) or elevators (28%).

In 31 cases fire involved more than one building due to inadequate clearance, inferior construction or exposed ordinary glass windows.

No watchman service was provided in 41% of the industrial fires occurring during nonoperating periods. Nonstandard watchman protection was used in an additional 25% of the nonoperating plants. Lack of proper watchman performance was noted in 27.3% of the fires where they were in sole charge.

Wide World

July 27, Detroit, Mich. Workmen engaged in repairing a blower in the fan room of the H. W. Rickel Malt Co. ignited grain dust accumulations with their welding and cutting torch. The building, three-equals-five stories in height, with walls of 2-in. x 6-in. laminated wood, metalclad, was destroyed along with 250,000 bushels of grain (mostly malted barley). A dust explosion complicated fire-fighting operations as did the lack of wall openings in the high structure.

Dorough Studio

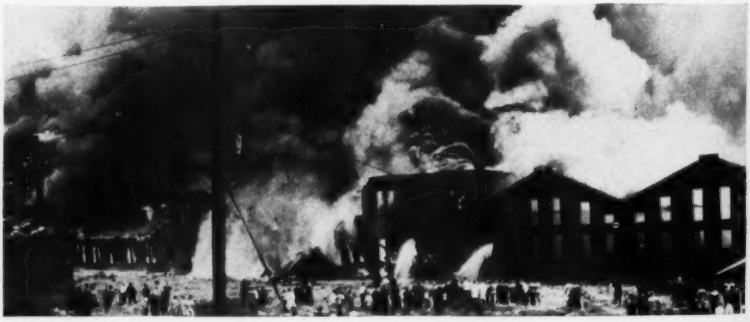
Oct. 30, Grand Saline, Tex. Fire in bundles of waste paper piled on the loading platform of the mill building of the Morton Salt Company plant spread when a 55-gallon drum of type cleaning solvent (used for cleaning type in cloth bag printing) ruptured. Flames entered openings of oversized doors where packaged stock and empty cartons provided additional fuel. While fire spread vertically through open stairwells and elevator shafts, it did not involve the adjoining salt warehouse due to a fire division wall (not parapeted), efforts of firemen and a favorable wind.

Milwaukee Journal

June 13, Cudahy, Wisc. The metallurgical laboratory of the Ladish Company was practically destroyed by a fire which is believed to have been caused by a short circuit in electrical wiring igniting a highly combustible drop ceiling. The entire building, 1900 ft. by 200-350 ft., lacked fire cut-offs. The roof was 2-in. wood plank on exposed steel, with a drop ceiling of highly combustible fibreboard on wood framing, insulated by paper-covered redwood bark batts. Despite the noncombustible and glass walls which gave the unsprinklered building an outward appearance of fire resistance, the structural deficiencies mentioned above condemned the plant. The loss is estimated at $504,500.

Minneapolis Star

Jan. 15, Minneapolis, Minn. The escape of 112 employees from this 3-story unsprinklered plant might be considered almost a miracle when fire started on the first floor at a cutting machine for aluminum castings. Due to the use of flammable liquids fire flashed rapidly through the entire structure, which was one fire area with vertical and horizontal openings unprotected. The building was occupied by the Mechanical Division of General Mills, Inc., for the manufacture of pressure cookers. The loss included $580,000 on business interruption insurance, $646,000 on equipment and merchandise, and approximately $200,000 on the buildings.



Acme

April 12, Jersey City, N. J. The private fire brigade at the Crucible Steel Company plant in Jersey City fought this fire for some time before calling the Jersey City Fire Department. By the time public fire equipment reached the scene, the fire, feeding on oil-soaked floors, spread through the 2-story brick rolling and drawing mill buildings. Winds of 15 to 20 mph further spread the flames and 28 hose lines had to be used to secure control.

Acme

Dec. 15, River Rouge, Mich. About 4,000 sprinklers operated at this fire in the Ford Motor Company plant, but the area originally involved was not sprinklered. Full details are not yet available but the fire originated in the upholstery storage area and spread through unprotected openings to the final assembly line for Mercurys.

Courier-Journal and Louisville Times

Sept. 15, Louisville, Ky. This photograph of the fire which destroyed the Kentucky and Finger Paper Box Companies' 5-story plant in downtown Louisville indicates how firemen were forced to pour water into the heavily-laden structure from ladder pipes, towers, and turret guns. Delayed detection, the absence of automatic protection, and heavy stock concentrations were chiefly responsible for this loss. One exposed structure, equipped with outside sprinklers, was saved when the system was turned on.

Acme

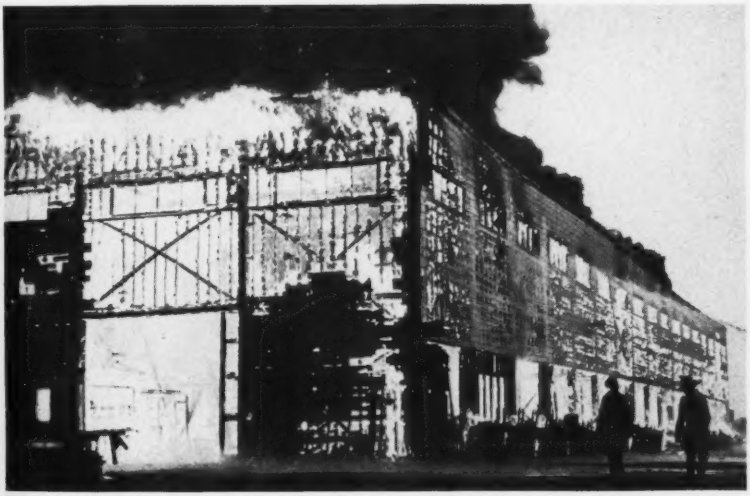
May 15, Everett, Mass. One employee was killed when fire originated in the tar dehydrating section of this congested Boston Consolidated Gas Co. plant in Everett. Lack of a dike permitted burning tar oil to spread rapidly along the ground and an explosion inside the dehydration unit indicated lack of sufficient relief venting.

Acme

Dec. 9, Tecumseh, Kans. Nine men were killed and 16 hospitalized from an explosion, believed caused by an accumulation of sewer gases, in a 6 ft. unvented air space beneath the basement of the boiler room. Two subsequent explosions due to the rupture of a 10-inch natural gas line spread fire through the building but did not cause structural damage due to adequate venting facilities (windows and skylights).

Acme

Sept. 3, New York, N. Y. Twenty engine companies (including three fire boats) were needed to control fire in this building occupied by manufacturers of cattle and dog food. Plain glass windows and unprotected openings in division walls allowed spread from section to section of the dusty building.



Press Association

April 22, Bridgeport, Conn. Shortly after the Cilco Terminal had shut down and before the watchman started his first round, an outsider telephoned a fire alarm and a street box was pulled. The fire spread from one shed to the next, fanned by a 25 mph wind. Long hose lays were required due to the absence of a private yard system.

Robert Heston

Sept. 9, near Amarillo, Texas. Destruction of this hangar and its contents (including two aircraft, seventeen motor vehicles, spare parts, etc.), shows the effects of uncontrolled fire in a hangar possessing severe structural and occupancy fire hazards and lacking basic protection safeguards. The undivided hangar was 299 ft. long, 165 ft. wide, and 30 ft. high. Walls and roof were asphalt and asbestos coated metal, backed by two thicknesses of 1/2-in. fiberboard. Fire was discovered by an outsider a mile away. By the time apparatus had traveled the 10 1/2 miles to the scene, it was apparent that the building was doomed and all efforts were directed toward saving the exposed hangar visible at left.

MISCELLANEOUS

11 Schools	4 Country Clubs
7 Churches	3 Forest Fires
7 Miscellaneous	2 Garages
6 Aircraft Hangars	2 Laundries
6 Petroleum Production and Distribution	2 Mining Properties
5 Lumber Yards	2 Piers
	1 Bowling Alley
	1 Public Building

59 Total

The 59 fires in this group represented a total loss of $26,288,500. Four of the group had individual losses of $1,000,000 or over.

Particularly affecting the average American were the eleven school fires during 1948 with total losses exceeding $4,000,000. The Ogden Meadows High School in Vancouver, Wash., involved the largest single loss ($827,000) and was set by a 15-year-old boy. Two other incendiary fires destroyed the Weston High School at Weston, Mass., on April 7 and the Academy of the New Church at Bryn Athyn, Pa., on November 11. Lightning was responsible for the destruction of the Herrin High School at Herrin, Ill., April 5 and the West Louisville (Kentucky) Elementary and High School on August 29. Lightning protection was not afforded these structures.

During a period when construction costs are at their height, replacement of the seven churches that burned with losses over $250,000 (five in 1947) present real problems to their congregations. Arson was the cause of two of these fires. It was noted that church trustees failed to increase their insurance coverage to match property values and in two instances insurance carried was only one-third of the actual value.

Practically all phases of the production and distribution of petroleum products were involved in large loss fires during 1948. On September 6 at Leduc, Alta., the Wild Atlantic No. 3 oil well burst into flames and burned for three days. The British American Oil Company's plant at Toronto was one of two refineries extensively damaged. Fire of May 15 at Glenwood Springs, Colo., originated on the premises of a wholesale distributing plant and spread to two bulk plants and a freight depot. Another group fire, this one in Chambersburg, Pa., started with an explosion of gasoline vapors in the basement of a service station.

Of the six aircraft hangar losses exceeding $250,000 the worst was at Quonset, R. I., on October 15, where the loss was $2,000,000. In the other five, 104 aircraft were destroyed.

Although 1946 and 1947 did not experience any $250,000 fires in country clubs, four such fires occurred in 1948. Destruction of the Wakonda Club on the outskirts of Des Moines, Iowa, following a lightning strike caused the greatest single loss, $366,000. This building was without lightning rods, and as in the case of most country clubs, was located in a suburban district lacking adequate water for fire fighting.

Three forest fires are included in the list of large loss fires. If it were possible to evaluate accurately damage by soil erosion accelerated by such fires, the list would undoubtedly be larger.

Four of the five lumber yard fires in this study extended to other buildings.

Piers continued to be represented among the large loss fires, and for the same reasons as in past years — large undivided areas of combustible construction inaccessible for fire fighting.

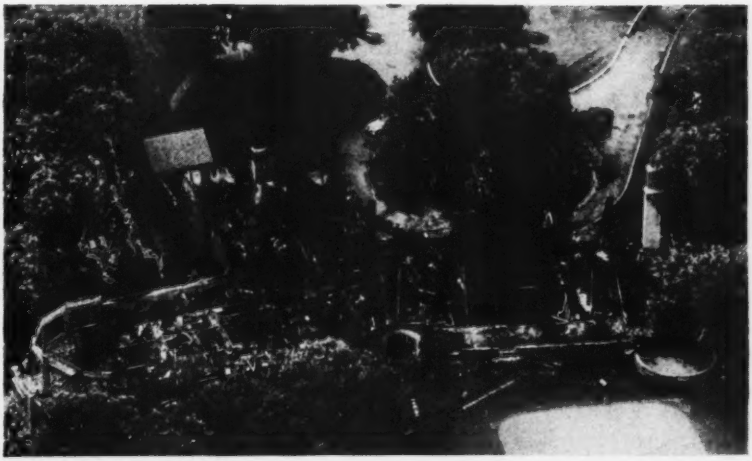
etc.), shows the effects of uncontrolled fire in a hangar [illegible] and 30 ft. high. Walls and roof were asphalt and asbestos coated metal, [illegible] safeguards. The undivided hangar was 299 ft. long, 165 ft. wide, and [illegible] away. By the time apparatus had traveled the 10½ miles to by two thicknesses of ½-in. fiberboard. Fire was discovered by an outsider a mile away. By the time apparatus had traveled the 10½ miles to the scene, it was apparent that the building was doomed and all efforts were directed toward saving the exposed hanger visible at left.

Los Angeles Times

Sept. 12, Wheelers Hot Springs, Calif. Liquefied petroleum gas escaping from a corroded vaporizer coil ignited and threw a flame 30 feet into the foliage of an oak tree overhead. Flames spread into brush and before being controlled burned over about 15,000 acres and destroyed seventeen dwellings, an orchid farm and forest improvements. The full effects of this fire will not be felt until later, as rain may well cause tremendous soil erosion on the denuded mountain slopes.

Acme

Jan. 22, Chester, Pa. Fire destroyed 32 buses, six trucks and this old car barn used for bus garaging and repair by the Southern Pennsylvania Bus Company. While a bus was being refueled inside the building spilled gasoline ignited, possibly at the hot exhaust pipe, causing the frightened employee to drop the nozzle and run. The contents of two 2,000-gallon gasoline tanks were subsequently discharged into the fire area when flame burned through the pump hose. The inside and roof of the undivided and unsprinklered structure were involved when firemen arrived.



Des Moines Register and Tribune

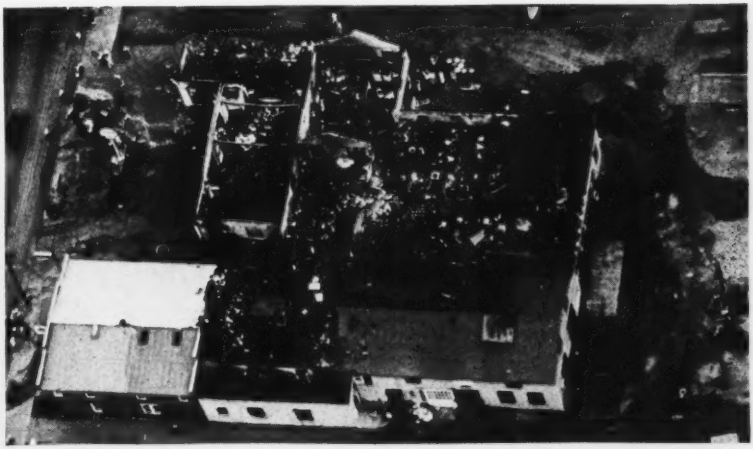
July 19, Des Moines, Iowa. The lack of adequate public and private fire protection evident at the Wakonda Country Club fire is typical of the large loss country club fires of 1948. Fire started beneath the roof when lightning struck the unrodded building. Apparatus three miles away was summoned at once, but on arrival could not produce even one good stream from the two yard hydrants located near the end of an old ½-mile long 4-inch main.

Acme

Jan. 20, Quincy, Mass. A nine-year-old boy confessed to taking papers into the vestibule of the Sacred Heart Roman Catholic Church and starting a fire against the wall. Due to the headway of the fire when apparatus arrived, inside fire fighting was largely impossible until the roof burned from the main church. An adjoining chapel was damaged when fire burned through a hollow tile partition and into a concealed space above the lofty ceiling.

Acme

Feb. 1, Schenectady, New York. A fireman died of overexertion while fighting this fire in the First Reformed Church. The blaze started near one of the six hot air furnaces in the basement and spread to the first floor and steeple through open stairways.

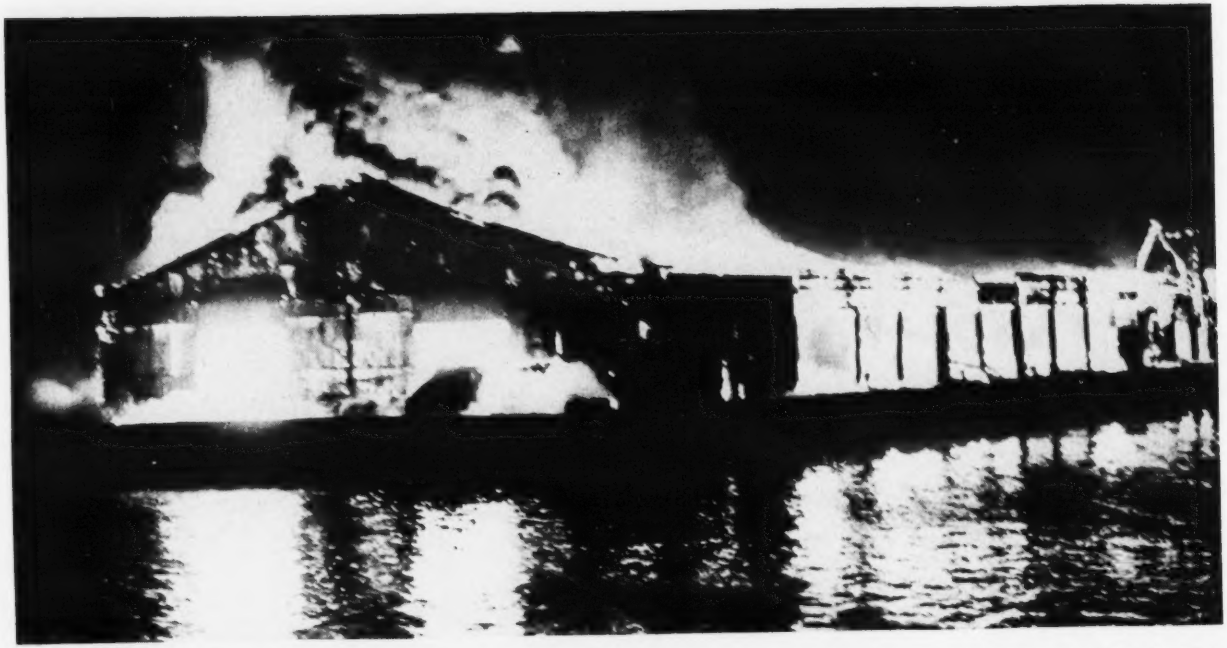


Ken Plummer

July 12, Chambersburg, Pa. Ignition of gasoline vapors in the basement of the Pryor Tire Service is believed responsible for the explosion that ripped apart the building and started the fire which spread to the adjacent 2-story premises of the Chambersburg Implement Co. Leakage of gasoline from the underground storage tanks had been evident for several days. Two defective hydrants complicated fire-fighting strategy and delayed control.

Acme

June 26, Louisville, Kentucky. Twenty-nine petroleum products storage tanks of the Aetna Oil Company were destroyed by fire that originated near the base of a spheroid tank of natural gasoline. The gasoline discharged from the tank through a disconnected but uncapped pipe and ignited from an unknown source. Explosion of the spheroid tank involved other tanks in nearby diked areas. (See NFPA Quarterly, October 1948, Page 100.)



International News

Jan. 6, Brooklyn, N. Y. The complete involvement of this pier by fire is apparent from the photograph. Fire companies working from the land end could do little to extinguish such a blaze. Fire boats were forced to concentrate on the 8,000-ton freighter S. S. *Rio Parana* which had been berthed at the pier and consequently had become involved in the fire. The ship was towed away from the blazing pier by a tug and the fire in her superstructure extinguished by the fire boats after 50 crew members were forced over the side of the vessel. Two steel barges were slightly damaged, and a third, loaded with copra, sank at the pier. The loss was estimated at $827,000.

Toronto Globe and Mail

Feb. 11, Toronto, Ont. Fire originating at a fuel oil truck on the property of the British American Oil Co. spread to involve four buildings, fourteen 10,000-gallon tanks of fuel oil and alcohol, and hundreds of drums of petroleum by-products. The extent of the fire, serious as it was, might have been much more disastrous since the plant was located on a five-acre tract in the Toronto industrial waterfront area. Exposures included other oil company bulk plants and the local gas works. Great credit for the "stop" is due to the Toronto Fire Department, which used 21 pieces of apparatus and 7,000,000 gallons of water on the fire.

Press Association

April 8, Marysville, Calif. The lumber yard of the Diamond Match Co. had occupied its present location for a long period of years, during which time it had been gradually hemmed in by dwellings, stores, and public buildings, all of combustible construction. During the night fire broke out in a lumber shed and burned a considerable time before discovery. It is not surprising that with delayed detection and strong shifting winds, flames destroyed five lumber sheds, yard stored lumber, seven dwellings, a church, four private garages, and two metal working shops.

Associated Press

May 31, So. St. Paul, Minn. A small fire discovered in a hay shed in the So. St. Paul stockyard overpowered an inadequate water supply and spread with prairie-fire speed through a 50-acre area, destroying eleven blocks of pens, three hay barns containing 30,000 tons of hay, 140,000 sq. ft. of roofed-over "chute," and 88 cattle cars on exposed sidings. Yard hydrants were not readily accessible and were supplied by long runs of various sized mains that also furnished a constant flow of water to the many watering troughs. An unusually large amount of tinder-dry refuse that had accumulated in the pens during the period of a recently settled strike contributed to the rapid spread of the fire.

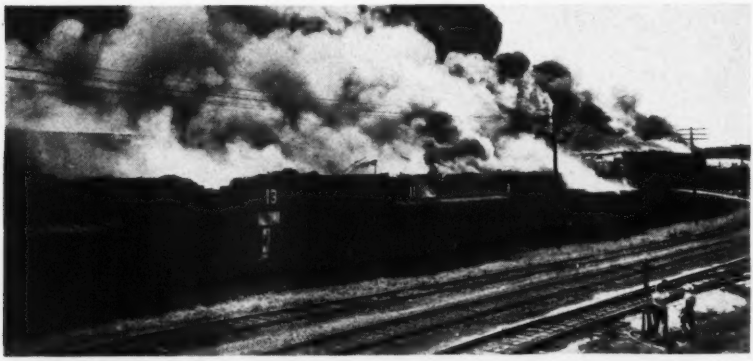
Oct. 3, Old Orchard Beach, Me. This fire in lightly constructed wood amusement buildings at Old Orchard destroyed the Roller Coaster, the "Old Mill" and a number of other combustible structures in the congested area. The alarm was sounded at 3:45 P.M. and it was 6 o'clock before the fire was under control. Aid from four fire departments, including Portland, assisted the local firemen.

Frank Cushing, Boston Traveler

April 7, Weston, Mass. This attractive brick colonial-type school building was the victim of a 17-year-old arsonist, who has since been sent to the State Reformatory for six years. The blaze was discovered at 12:02 A.M. by an outsider, who telephoned the Weston Fire Department. The fire spread through concealed spaces or ducts. At 2:00 A.M., it was still out of control and aid called from five surrounding communities.

Hugh Stovall

Sept. 17, near Atlanta, Ga. Shortly after an employee raised a burning paper to the eaves in an attempt to burn out a wasp nest, smoke was observed coming from the roof of the E. Rivers School. Fire spread rapidly through the undivided attic. Located in an unincorporated area outside Atlanta, the community fought annexation and yet relied on Atlanta and other neighbors for fire protection. The lack of a community fire department and an adequate water system were serious handicaps which resulted in the total loss of the school.



St. Louis Globe Democrat

Aug. 19, St. Louis, Mo. This fire in a warehouse of the Frigidaire Sales Corp. started in a pile of refuse near the loading platform. Flames jumped to packing cases on the platform and despite the efforts of employees using first aid equipment extended through the large undivided structure through open freight doors and spread over stock piled to the bottoms of steel roof trusses. Delay in getting water on the fire was necessitated by remoteness of hydrants.

Acme

July 9, Cleveland, Ohio. Damage to stock steel in the 3-story warehouse of the U. S. Steel Supply Co. is estimated at $200,000. Fire was discovered in the second floor office by the watchman at 3:10 A.M. Instead of giving the alarm at once over the private fire alarm box, he attacked the fire with pails of water, and it spread into the undivided and unsprinklered storage area.

WAREHOUSING

10 Terminal	2 Chemicals
7 Grain, Seed	2 Leather
7 Hardware, Machinery, Metal	1 Cotton
7 Multiple Occupancy	1 Fur
5 Food	1 Furniture
4 Electrical Appliances	1 Glass
2 Builders Supplies	1 Tobacco
	1 Wood
	—
	52 Total

During 1948 there were 52 large loss warehouse fires with aggregate damages of $25,848,000. Of these fires, seven had individual loss of $1,000,000 or more.

Certain facts stand out from a review of these fires. First is the high proportion of the fires that broke out during nonoperating periods (73%). Automatic detection equipment was present in only one warehouse. Watchman protection was particularly weak. Twenty-one warehouses left no one on the premises after closing, and of the seventeen with watchmen, the service was nonstandard in eight instances. Eleven of these seventeen watchmen failed to perform their emergency duties properly.

Also notable was the absence of adequate sprinkler protection. Forty-nine warehouses had no sprinklers. Deficiencies listed in Table 19 account for the ineffectiveness of sprinklers in the three buildings so protected.

Unprotected doorways, open stairways and elevator shafts were prevalent in these 52 warehouses and were major factors contributing to fire spread. Fire-safe storage practices were ignored repeatedly. High concentration of storage in a single fire area was noted 46 times and poor stock subdivision in 23 fires.

Two warehouse fires with losses exceeding $1,000,000 occurred in unincorporated communities where public fire protection was totally lacking. Groceries valued at $2,000,000 were destroyed in the Colonial Food Stores Warehouse, October 8. Firemen responded from Durham, N. C., nine miles away, but were forced to stand by helplessly for the lack of a water supply.

Among the storehouses, terminal warehouses were the outstanding type sustaining large loss fires, the most severe of which was the Canadian National Railway freight terminal fire at Montreal, August 23. Truck terminal properties sustained seven major fires, with a total loss of $2,785,000.

The large loss fire experiences of 1948 should dispel any doubt that stored metal and metal products can experience serious fires. Seven fires, involving storage of stock steel, farm equipment, machinery and automotive parts caused damage totaling $3,332,500, of which $2,611,000 represented damage to stored material.

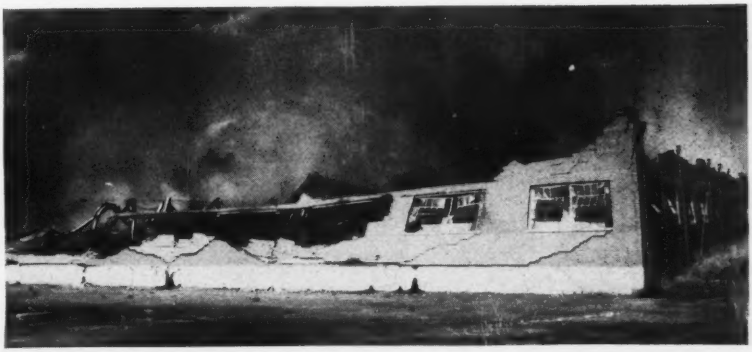
Grain, feed and seed warehouses and elevators occupy a prominent position in the 1948 large loss fire record with seven fires. The majority occurred in small communities where volunteer fire departments had neither equipment nor water supplies adequate to control major fires.

Four electrical appliance warehouses suffered losses exceeding $250,000 during 1948. Loss to the buildings with their stocks of radios, stoves, refrigerators, washing machines and other electrical equipment totaled $1,601,500.

Regarding causes of warehouse fires, the common hazards of heating, lighting, smoking, storage and handling of flammable liquids and gases predominated. In addition, four fires originated in grass or trash outside the building and spread into the structure through open stock doors or plain glass windows.

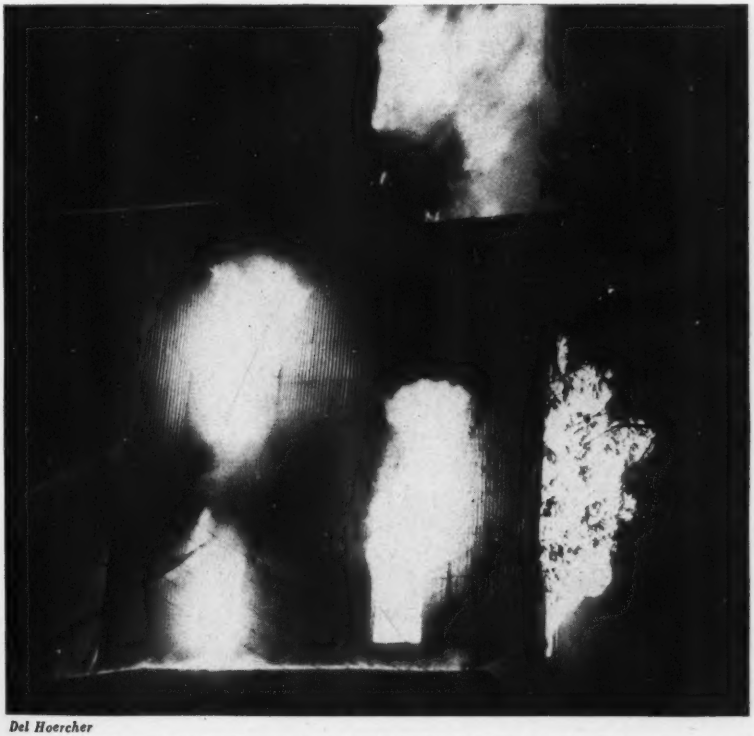
Len McAllister

Aug. 23, Montreal, Que. Two 1000 ft. long wooden freight sheds, some 150 freight cars and contents were destroyed by this fire, with a loss estimated at $2,000,000. The fire started as a result of attempts to clear a clogged truck gasoline line with compressed gas from a cylinder. The main lesson, however, is the lack of fire divisions in the large combustible sheds filled with freight. Sixty hose streams were required to bring the fire under control.



Herald Sun

Oct. 8, near Durham, N. C. The Colonial Food Stores Co. stored groceries valued at $2,000,000 in this warehouse located nine miles from the nearest fire department.



Del Hoercher

July 8, Mascoutah, Ill. Firemen had fought fire in the Postel Milling Co.'s elevator on a blackboard for twenty years. This preplanning is believed responsible for the success in controlling this blaze (despite a limited water supply) before a hotel, mill and other exposed buildings in the business district could become involved. Fire started in the first floor control section and had spread to the head house before discovery.

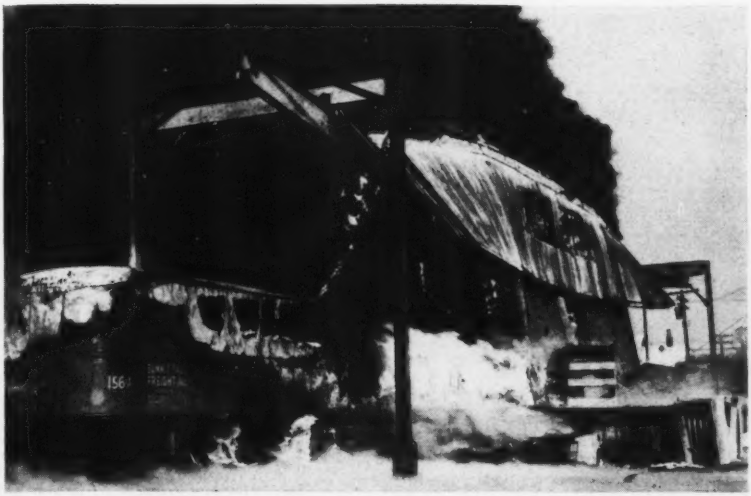
estimated at $2,000,000. The fire started as a result of attempts to [illegible] lesson, however, is the lack of fire divisions in the large combustible sheds filled with freight. Sixty hose streams were required to bring the fire under control.

Wide World

Sept. 16, Windsor, Ont. Fire when discovered was confined to one end of this 536-foot-long wooden shed, but when sliding doors were opened to get at the blaze, flames quickly enveloped the entire structure. The building was knocked down and the fire brought under control by water from turret guns of a fire boat. The Windsor Star and the General Electric Co. of Canada occupied the structure for the storage of newsprint and electrical equipment.

Acme

Jan. 21, Washington, D. C. The Marine Corps and the State Department occupied most of this former roller skating rink for miscellaneous storage and as a repair shop. The odor of smoke gave first warning of a smoldering fire that gained headway before the guard gave up his search for the source and called the fire department.



Acme

Feb. 5, Cleveland, Ohio. The Interstate Motor Freight System's terminal, a large amount of freight, and fourteen trailers were destroyed by fire caused by a defective gravity feed oil heater in the office. Employees used several extinguishers without success before calling the fire department. Before firemen could get into action, however, the oil stove exploded and flames spread rapidly through the undivided and unsprinklered combustible structure.

Acme

April 24, Clinton, Mass. Sprinklers in this and in two adjoining buildings of a former carpet mill had not been kept in service by their present occupants. During the night, fire broke out in the truck terminal of the Clinton Express Co. and spread through unprotected openings to destroy two other buildings. (See July 1948 Quarterly, Page 51.)

Goldsboro News-Argus

Feb. 9, Goldsboro, N. C. An employee who attempted to use hand extinguishers without calling the Fire Department was unwittingly responsible for the extent of this disastrous fire in Weil's Department Store. The falling wall illustrated above remarkably did not cause fatal injuries to any one, but is symbolic of how the fire engulfed the three-story brick and wood structure after starting in an innocent looking trash box near an open elevator shaft.

Acme

Feb. 14, Trenton, N. J. Fire proved that this modernistic front of Binder's Department Store concealed an 80-year-old building. After continued heat attack for 3 hours and 15 minutes plus the sudden cooling effects of multiple hose streams the walls were so weakened that a cave-in occurred in two portions which required subsequent demolition of the entire structure by a wrecking contractor. The fire was actually confined to the fourth floor and an open loft on the fifth story.

MERCANTILES

11 Department Stores	1 Five and Ten Cent Store
10 Multiple Occupancy Stores	1 Grocery Store
6 Furniture Stores	1 Restaurant
3 Hardware Stores	1 Stationery Store
2 Drug Stores	
	36 Total

Damages caused by these 36 large loss mercantile store fires totaled $15,950,000, caused 5 deaths (3 to firemen) and injured 73 persons (69 firemen). In three cases, the loss exceeded $1,000,000.

Particularly disturbing were the 14 fires that jumped from the building of fire origin to other exposed structures. In two cases, flames and radiated heat involved substantial structures across wide downtown streets, although in the majority of cases inferior construction, inadequate clearance and ordinary glass windows permitted exposed structures to become involved.

The worst fire in point of dollar loss occurred at the John Bressmer & Company department store in Springfield, Ill., on May 2 This structure was a fire-resistive building and yet fire traveled from floor to floor via open stair and elevator shafts to involve the combustible contents on each floor. It is believed that lightning struck the elevator penthouse to originate the blaze. The fire of April 14 at Laramie, Wyoming, caused a loss of $1,300,000, destroyed nine buildings and damaged eleven others. The same sort of fire occurred on June 4 in Duluth, Minn., where three buildings were totally destroyed and four others (including a fire-resistive office building) were heavily damaged. This fire, starting in the basement, was not detected until a passerby noted flames in the aboveground floors.

Lack of automatic protection was evident in 34 of the 36 large store fires and in the other 2, where only partial protection was afforded, fire originated in unsprinklered sections.

Sixty-four per cent of the fires occurred between 6:00 P.M. and 6:00 A.M. and 72% of the properties were *not* operating when the fire broke out. Of the 26 stores not operating at the time of the fire, 20 had no watchman service, 4 had only nonstandard watch protection, leaving only 2 where standard service was provided. In three cases the watchmen on duty did not perform their emergency duties with proficiency due either to lack of employee training or poor selection of personnel.

Delayed detection was a feature in 25 of the 36 mercantile large loss fires. Outsiders, police or firemen, detected 24 of these fires while only 9 were detected by employees and 3 by watchmen.

Delayed transmission of alarm was noted in 10 cases and in 8 of these employees or watchmen first attempted to extinguish the fire with hand extinguishers, calling the fire department only after failure to succeed. Twenty-three of the alarms were turned in by telephone, only eight by street fire alarm boxes. One alarm had as its origin a taxicab radio.

Structural conditions also followed a pattern. Twenty-six of the buildings were the conventional brick, wood-joist structures, 24 had open stairwells and 14 open elevator shafts. Thirty-seven per cent of the fires in buildings with basements originated in these below ground areas.

Heavy storage of combustibles, poor stock subdivision and poor housekeeping conditions were also notable factors in the large loss mercantile fires of the year.

extinguishers without calling the ... fire in Weil's Department Store. ... sible for the extent of this disastrous ... The falling wall illustrated above remarkably did not cause fatal injuries to any one, but is symbolic of how the fire engulfed the three-story brick and wood structure after starting in an innocent looking trash box near an open elevator shaft.

... effects of multiple hose streams the walls were ... in occurred in two portions which required subsequent demolition of the entire structure by a wrecking contractor. The fire was actually confined to the fourth floor and an open loft on the fifth story.

Press Association

Feb. 16, Durango, Colorado. Long burning prior to discovery was self-evident when a heat explosion blew out the front windows of the Durango Mercantile Co. as firemen arrived. The local Fire Department was helpless in its attempt to secure control and mutual aid from neighboring towns arrived too late to be of material assistance. Sparks threatened other exposed buildings, but these fires were extinguished with minor damage. The loss is estimated at $615,000.

Carrol C. Hall

May 2, Springfield, Ill. Fire destroyed the entire stock of the John Bressmer and Co. department store and so damaged the 6-story fire-resistive building that much of it will have to be rebuilt. Originating in the elevator shaft during a severe electrical storm, fire extended to the three upper floors almost simultaneously through unprotected openings and spread to other floors of the unsprinklered building through open stairways. (See NFPA Quarterly, July 1948, Page 60.)

Jimmie Willis Photo

Sept. 27, Waco, Texas. Detection was delayed in the heavily stocked store of the J. C. Penney Co. until fire was discovered by a bus driver. An open space aided fire spread from first floor to the roof in the middle of the high 1-story building (with balconies front and rear). On Aug. 7, 1942 a similar fire in this building caused a loss of $175,000. The owner is now installing automatic sprinklers.

Acme

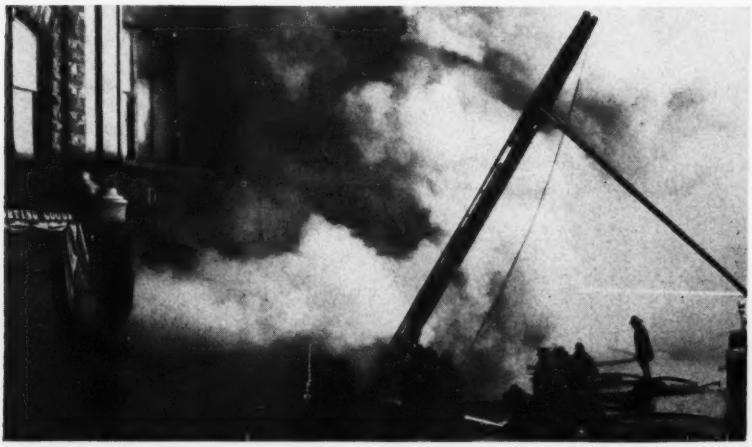
June 4, Duluth, Minn. Fire in the basement of the Rudolph Furniture Store made terrific headway before discovery. Unprotected floor openings, lack of automatic protection plus large amounts of combustibles prevented control. Three exposed buildings were heavily damaged, including a fire-resistive structure located across a 62 ft. wide street where radiated heat melted window glass, and ignited combustible trim and office furniture.

Wide World

Nov. 12, Richmond, Va. Originating at the top of the elevator shaft in Rountree's Furniture Store, fire entered the top floor of the 4-story building through an unprotected shaft opening, broke through the roof and spread to the sixth floor of the adjoining 6-story Masonic Temple via unprotected window openings. Neither building was sprinklered.

San Francisco Chronicle

May 15, San Francisco. Nineteen hose lines and 3 water towers were required to extinguish this fire in the United Automotive Supply Store. A Battalion Chief died of smoke inhalation and a heart attack. (See Quarterly, July 1948, Page 58.)



Gazette

Feb. 15, Kalamazoo, Mich. Another fire originating in the basement of a typical mercantile store without automatic protection produces heavy volumes of smoke at the Doubleday Bros. & Co. stationery outlet. Fire was discovered at 8:06 A.M. four hours after the last visit by a merchant policeman.

TRANSPORTATION

17 Aircraft
2 Railway Rolling Stock
1 Ship
—
20 Total

Large loss fires affecting transportation equipment caused total damages estimated at $20,087,000. In this group there were six fires where the loss was $1,000,000 or over.

By far the largest fire as regards dollar loss was the destruction of the U. S. Army Transport *Joseph Connelly* at sea on January 12. Fire originated from an oil leak in the engine room. The vessel had to be abandoned in mid-ocean and the loss to the vessel is estimated at $1,500,000 and $4,500,000 to the cargo of caskets destined to return war casualties to the United States.

While aviation improved its safety record during the year, six scheduled air carriers and eleven service planes were destroyed by fire either in flight or on the ground with losses in excess of $250,000. The worst such disaster was the crash of a United Air Lines DC-6 aircraft near Mount Carmel, Pennsylvania, on July 17. This fire-disabled passenger aircraft crashed and burned on a hillside, killing all 43 persons on board. Other airborne fire accidents included two B-29 power plant fires, resulting in the deaths of all 26 occupants of both aircraft.

The aircraft accidents on the ground involved eight cases where the aircraft were attempting to make a normal or emergency landing, four cases at or shortly after take-off and one case during aircraft maintenance operations. Two of these three accidents involved Lockheed "Constellations" and in both cases large fuel spillages from wing tanks prevented control by such emergency fire-fighting equipment as was available. The other accident involved a DC-4M, with similar failure of wing fuel tanks. These tank failures are considered design shortcomings.

One of the worst scheduled airline disasters was the Delta Airline accident at Chicago on March 10, where twelve persons died, seven from burns, when the aircraft crashed after stalling at 600 ft. soon after take-off from the Municipal Airport. About 1,800 gallons of gasoline was involved in this fire which could not be controlled by multiple units of standard city fire-fighting equipment which were rushed to the scene from neighborhood fire stations. All these accidents point to the need of specialized aircraft rescue and fire-fighting equipment for airports.

It should be specifically mentioned that excluded from this record of aircraft fires are those crashes involving high impact forces where fire was neither responsible for the accident nor the deaths which followed.

The one fire occurring during aircraft maintenance destroyed a Trans World Airlines DC-4 on the ramp at LaGuardia Field on September 28. The accident occurred while the oxygen system of the aircraft was being filled preparatory to flight.

The railway accidents of the year where the loss was over $250,000, involved freight equipment and there was no loss of life involved. The worst of these accidents occurred on November 15 at Renault, Illinois, on the Missouri Pacific and St. Louis Southwestern Railways. In this accident a Diesel locomotive, 10 loaded and 4 empty boxcars were destroyed and other cars damaged by fire following the derailment.

Acme

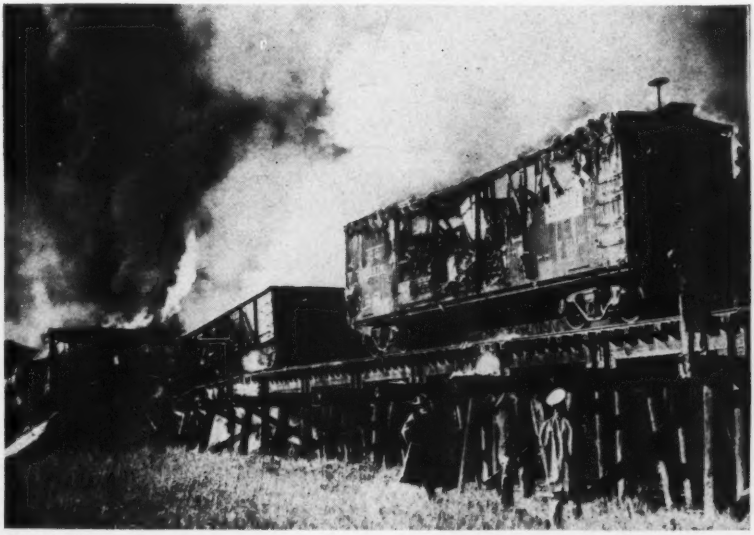
Jan. 21, Boston, Mass. Twenty-five passengers and crew members escaped from this burning Eastern Air Lines "Constellation" following its landing at the Logan International Airport. Wing rupture at impact with banked snow on the runway edges caused large fuel spillage from integral type fuel tanks and lack of adequate aircraft fire fighting equipment and personnel prevented saving the high valued plane. Passengers were required to jump from the doors to the ice-covered runway and snowbanks, several being badly injured during this evacuation.

N. Y. Daily News

Sept. 28, New York, N. Y. An explosion and fire during oxygen servicing of this Trans World Airline DC-4 caused damage estimated at $337,500 to this aircraft. It is believed that combustible material accumulated, during service, in or near the regulator in the servicing cart and that the rapid build-up of pressure during the filling operation fired the material. About 25 ft. of the oxygen servicing line was involved in the explosion and the resultant fire gutted the interior of the aircraft as several thousand cubic feet of oxygen fed the flames. (There is no way to drain oxygen outboard in the event of such a leak in this type aircraft.)

Wide World

Nov. 25, Los Angeles, Calif. A design factor was undoubtedly responsible for this fire which destroyed a Transcontinental Western Airlines "Constellation" after a hard landing at Los Angeles Airport. The practice of using the fuel tank supporting members for landing-gear support (where any shock is transmitted directly to the tank and where gear collapse punctures the tank) introduces the hazard of large fuel spills, which in the presence of hot engine surfaces or electrical sparks might cause instantaneous vapor ignition. This is apparently what happened and the lack of specialized aircraft fire-fighting equipment instantly available on the field prevented control.



Wide World

Nov. 11, Fruitland, Ala. While reasonable estimates of the damage caused by fire following this derailment are not yet available, the amount of loss will undoubtedly exceed $250,000. Thirty-six cars and their contents were destroyed and the railroad trestle was severely damaged by fire. Flammable liquids from overturned tank cars ignited and flames spread to wooden boxcars.

Acme

June 14, Sheffield, Ala. This building, erected in 1883, with additions in 1890 and 1918, was occupied as the Sheffield Hotel. Unprotected vertical openings and lack of automatic protection were obvious shortcomings in the structure, but just how the fire gained so much headway before being detected by a passerby at 10:42 P.M. is not clearly indicated. Earlier in the day (4 P.M.) a fire had occurred in the elevator penthouse and firemen remained at the property until 7 P.M. Apparently a rekindling occurred and flames spread down the vertical shaft without being noted by occupants. Fire escapes permitted evacuation of all tenants except for one who was rescued down a ladder.

HABITATIONAL

6 Hotels
2 Hospitals
1 Dwelling

9 Total

Prompt detection and extinguishment are of utmost importance in hospitals, hotels and dwellings. Of the nine habitational occupancies experiencing large loss fires in 1948, none had automatic detection equipment, one had watchman service (nonstandard), and none was protected by automatic sprinklers. It is not surprising, therefore, that delayed detection was an important feature in all nine of these disastrous fires that took twelve lives and caused damage estimated at $3,356,000. The need for prompt alarm transmission following discovery of hotel and hospital fires is also emphasized.

Structural features played prominent roles in the spread of these fires, the most frequently noted being open stairwells (7) and large undivided attics (4).

The six largest hotel fires of the year took three lives, all in one fire. The one fatal fire in this analysis occurred on January 30 at St. Albans, Vt., where three persons were trapped on upper floors.

The Roney Terrace Hotel at Ste. Marguerite Station, Que., had just been built. Employees were the only occupants when fire broke out in a third floor room during the night. Delayed detection, open stairways and inadequate water for hose streams all contributed to its destruction and the loss of a number of adjacent cottages.

Fire in the undivided attic of the multistoried wooden Alamac Hotel at Mt. Arlington, N. J., also had ample time to spread before detection. The hotel was closed for the season. There was no local fire department and aid from surrounding towns was ineffective since there was no water supply.

A cigarette dropped down a laundry chute was the cause of fire in the Hotel Lapointe at St. Jerome, Que. The watchman discovered the fire in time to permit safe evacuation of the 53 guests asleep in the building. Inadequate hydrants, extreme cold and high winds hampered firemen.

Neglect of fire safety in the 163-room Sheffield Hotel, Sheffield, Ala., is indicated by the open stairways and elevator shafts, and absence of detection equipment and sprinklers. Guests managed to escape before fire in elevator penthouse burned down through the structure. Delayed detection and delayed alarm transmission were both noted in the report of the Del Mar Hotel fire at Santa Monica, Calif. A housemaid suspected fire in the attic and notified the desk. The fire department was not called until the house engineer had made an unsuccessful attempt to control the fire with extinguishers.

The Highlands Hospital fire at Asheville, N. C., on March 10 cost the lives of nine mental patients locked in their rooms. Originating at 11:44 P.M. flames traveled through open staircases in the three and five-story wood and stone building, cutting off normal exit routes. The fire was completely out of control upon arrival of the fire department. Investigation proved that a middle-aged woman serving as a nurse set the fire.

Another hospital fire occurred in Sardis, B. C., on November 19, but there, all 160 tuberculosis patients were evacuated without injury.

Press Association

Jan. 30, St. Albans, Vermont. Three guests were trapped on the upper floors of the Jesse Walden Inn, which was totally destroyed by a night fire when temperatures registered 21° below zero. Originating in the first floor cocktail lounge, the fire burned undetected until the owner, while checking the premises before retiring, opened the door from the lobby to the lounge. Flames burst from the lounge and up an open stairway and elevator shaft. It appears that the need for enclosing vertical openings and for automatic protection in hotels, given emphasis by the series of fatal fires in 1946, had not been learned.

Asheville Times

March 10, Asheville, N. C. Nine patients died when this unsprinklered hospital for mental patients was totally destroyed by fire. While it was set by a mentally deranged nurse in several places, the spread of fire through unprotected stairwells of wood construction would undoubtedly have occurred regardless of the origin. Balconies aided evacuation of those patients who could be led to safety from their locked rooms by hospital attendants.

July 11, Santa Monica, Calif. Eight vertical service shafts and a large, undivided attic spread flames through the Del Mar Hotel and Beach Club after employees delayed sounding the alarm for approximately 15 minutes. During this period, the house engineer attempted to control the fire in the attic with hand extinguishers. When he realized that he could not succeed, the hotel telephone operator was instructed to call the fire department. Sections of the sloping tile roof collapsed, endangering firemen on ladders and in the street. The roof cave-in also broke a standpipe supplying vitally needed 1½-in. hose lines on the seventh floor, but firemen stood their ground and succeeded in practically confining the serious fire damage to the upper two stories. (See NFPA Quarterly, October 1948, Page 92.)

Table No. 21

U. S. AND CANADIAN LARGE LOSS FIRES BY OCCUPANCY CLASSIFICATION

*Indicates "group" fire (spread to other structures).
†Includes business interruption insurance loss payments.

MANUFACTURING

Brick, Tile and Stone Working

*April	9	New York, N. Y. Originated in marble works and spread to lumber yard.	Colonna & Co., Inc., etc.	$425,000
June	15	Marshall, Texas Manufacture of brick and tile.	Marshall Brick Co.	300,000
Sept.	26	near Huntsville, Ala. Manufacture of brick and tile.	Phillips Brick and Tile Co.	275,000

Chemical Plants

*Feb.	6	Jacksonville, Fla. Production of rosin, turpentine, etc., with bulk storage tanks.	The Glidden Co. and Nelio Resin Processing Corp.	1,225,000†
*Feb.	6	No. Philadelphia, Pa. Manufacture of flammable solvents with bulk storage tanks.	Globe Solvent Co.	273,000†
Mar.	5	Cleveland, Ohio Paint, varnish, and lacquer factory with mixing and blending.	Arco Company	250,000†
Mar.	6	near Etter, Texas Anhydrous ammonia production from natural gas.	Cactus Ordnance Works	1,100,000
Mar.	14	Edgewater, N. J. Acetic acid production building.	General Chemical Corp.	250,000
April	19	Lisbon, Ohio Manufacture of "Sing" (a detergent), laundry supplies, water purifier, household cleaners, lyes, and starches.	Hood Chemical Co.	486,000†
*May	17	Kearney, N. J. Coal tar distillation plant.	Koppers Company, Inc.	500,000 10 killed

Electric Generating Plant

Dec.	9	Tecumseh, Kansas Steam turbo-electric generating station.	Kansas Power and Light Co.	250,000 9 killed

Food and Food Product Plants

Jan.	16	Portland, Mich. Flour mill and dog food manufacturing.	Valley City Milling Co.	250,000
*Jan.	30	Utica, N. Y. Originated in commercial bakery and spread to seed company.	Alan Baking Co., etc.	250,000
Feb.	12	Lakeport, Calif. Pear packing plant with store and office.	Lake County Fruit Exchange	260,000
April	13	Celina, Ohio Canning of vegetables (beans, tomatoes, asparagus, peas, etc.).	Stokeley Van Camp Canning Co.	390,000
*April	26	Lakemont, Fla. Citrus fruit packing and juice canning.	Gregg Maxcy, Inc.	350,000
May	7	West Memphis, Arkansas Expeller-type soybean oil mill and sweet mix feed mill.	Arkansas Mills	270,000
June	10	Mankato, Minn. Expeller-type soybean oil mill and feed mill.	Honeymead Mankato Co.	558,000
July	6	Seattle, Wash. Fish oil recovery and meat rendering plant.	Lyle Branchflour Co.	691,000† 4 killed
July	18	So. San Francisco, Calif. Manufacture of macaroni.	Hunt Food, Inc. (Fontana Division)	250,000
*July	27	Detroit, Mich. Malting plant with grain storage bins.	H. W. Rickel & Co.	1,057,000
*Aug.	16	Port Bailey, Alaska Salmon fish canning.	Kadiak Fisheries Co.	950,000

Sept.	7	Chicago, Ill. Manufacture of chocolate-covered candy with cream centers.	E. J. Brach & Sons	5,000,000† 17 killed
Oct.	22	Tunica, Miss. Cottonseed oil mill and gin.	Planters Oil Mill	400,000
Oct.	30	Grand Saline, Texas Salt works by vacuum, pan and evaporation process.	Morton Salt Co.	375,000
Nov.	10	Gibson Switch, Arkansas Rice mill with drier and storage tanks.	Northern Rice Milling Co.	330,000
Nov.	11	Champlain, N. Y. Manufacture of casein products from milk.	Irona Creamery Co.	340,000
*Dec.	11	Powellsville, N. C. Peanut cleaning, grating, and shelling.	Carolina Peanut Corp.	300,000
Dec.	29	Lake Wales, Fla. Canning and packing of fruit and preparation of animal feeds.	Florida Canners Co-operative	250,000
Gas Works				
*May	15	Everett, Mass. Production of manufactured gas; by-product storage, handling.	Boston Consolidated Gas Co.	2,000,000 1 killed
*Oct.	18	Melvindale, Mich. Production of manufactured gas.	Michigan Consolidated Gas Co.	560,000 1 killed
Glass Products Plant				
May	20	East Rutherford, N. J. Hypodermic syringes.	East Rutherford Syringes, Inc.	1,000,000
Hair Works				
*Feb.	8	Chicago, Ill. Manufacture of curled hair and sisal pads.	Chicago Curled Hair Co.	423,500†
Metalworking, Basic Processing				
April	12	Jersey City, N. J. Steel rolling and drawing mill being dismantled.	Crucible Steel Co. of America	766,000 1 killed
*July	3	Chicago, Ill. Steel mill.	Carnegie-Illinois Steel Co.	750,000 2 killed
Sept.	21	Lorain, Ohio Chemical research, production of beryllium and beryllium alloys.	Brush Beryllium Co.	350,000
Metalworking, Heavy				
Mar.	15	near Louisville, Ky. Engine testing and farm tractor manufacturing.	International Harvester Co.	250,000 7 killed
*Oct.	29	Pitcairn, Pa. Originated in railroad blacksmith shop and spread to warehouse.	Pennsylvania Railroad	550,000
Dec.	15	River Rouge, Mich. Automobile manufacture and assembly.	Ford Motor Co.	1,250,000
*Dec.	18	Valcartier, Que. Ordnance plant.	Valcartier Arsenal	1,000,000
Dec.	29	Glenwillard, Pa. Metal pipe manufacturing and coating.	Pipe Line Service Corp.	500,000
Metalworking, Light				
Jan.	14	Cleveland, Ohio Electrical supplies with motor rebuilding.	Elliott Electric Co.	269,000†
Jan.	15	Minneapolis, Minn. Manufacture of aluminum pressure cookers.	General Mills, Inc., Mechanical Div.	1,426,000†
*Jan.	20	Kokomo, Ind. Originated in neon sign plant and spread to lumber mill.	H. & K. Appliance Co.	368,000†
Jan.	23	Huntington, Ind. Metal products—hot air furnaces, fireplaces, incinerators, etc.	The Majestic Co.	605,000†
Jan.	28	Milwaukee, Wisc. Production of brass valves.	Milwaukee Valve Co.	443,000

Metalworking, Light (Cont'd)

Feb.	13	Detroit, Mich. Seat cushion and wire spring forming.	L. A. Young Spring and Wire Co.	420,000
Mar.	5	Englishtown, N. J. Manufacture of knives, forks, and general cutlery.	Englishtown Cutlery, Ltd.	1,221,000
Mar.	6	near Youngstown, Ohio Aluminum stripping for linoleum trimming.	Trimedge Industries, Inc.	302,000
*Mar.	22	near Bell, Calif. Manufacture of plumbing fixtures.	E. A. Vermere Die Casting Co.	269,000
April	20	Vineland, N. J. Metal poultry equipment, toys, etc.	Keen Equipment Co.	287,000
June	13	Cudahy, Wisc. Forged and seamless welding pipe fittings, etc.	Ladish Co.	504,500
*June	23	Detroit, Mich. Aircraft crashed into tool shop; fire spread to near-by dwellings.	Putnam Tool Co., etc.	395,000† 1 killed
July	14	Smyrna, Del. Manufacturing of milk coolers, deep freezers, refrigerators.	Wilson Cabinet Co., Inc.	600,000
Aug.	21	Clark Township, N. J. Production of roller bearings.	General Motors Corp.—Hyatt Bearings	250,000
Sept.	16	Stratford, Ont. Manufacture of rings and pistons.	Sealed Power Corp.	427,000
Oct.	1	St. Louis, Mo. Fire door manufacture.	St. Louis Fire Door Co.	300,000†
Oct.	18	Raritan Township, N. J. Commercial freezers and refrigerators.	Crown Refrigerator Co.	300,000
Oct.	19	Evansville, Ind. Refrigeration equipment.	Seeger Refrigerating Co.	500,000 1 killed
Nov.	2	Glen Riddle, Pa. Commercial refrigerators.	Sunroc Refrigeration Co.	250,000
Dec.	5	Toledo, Ohio Heat treating and galvanizing works, tubing.	Commercial Metals Treating, Inc.	327,000

Paper Products Plants

May	16	Monroe, Mich. Paper mill and paper box factory.	Monroe Paper Products Co.	300,000
Sept.	15	Louisville, Ky. Paper box factory and storage.	Kentucky Paper Box Co., Inc. and Finger Paper Box Co.	271,500†
*Sept.	26	Brownstown, Ind. Paper packing products.	Kieffer Paper Co.	442,000†
Dec.	11	Plattsburg, N. Y. Paper products, including toilet and facial tissues, towels, etc.	Berst-Foster-Dixfield Division, Diamond Match Co.	425,000

Plastics Plant

Mar.	6	Waltham, Mass. Phenol formaldehyde molding compounds.	Interlake Chemical Corp.	250,000 5 killed

Printing Plant

Dec.	18	La Salle, Ill. Newspaper publishing and printing.	Daily News-Tribune	250,000†

Radio and Radio Equipment

May	25	Boston, Mass. Assembly of underwater signaling equipment.	Submarine Signal Co.	300,000†

Rubber Works

*Jan.	2	New York, N. Y. Fabricated rubber specialties, etc.	H. Goldman, etc.	546,000

Textile Workers

Feb.	21	Long Beach, Calif.	Bayly Mfg. Co.	314,000
		Overall manufacturing with incidental mercantile occupancies.		
*Feb.	26	Cohoes, N. Y.	Troy Waste Co.	260,000
		Cotton waste products.		
Mar.	19	Waterville, Que.	Waterville Textile, Ltd.	400,000
		Cotton, wool, and rayon mill with piece goods manufacture.		1 killed
April	21	Libertyville, Ill.	Libertyville Textiles, Inc.	925,000†
		Cotton rug weaving.		
Nov.	14	Cold Spring, N. Y.	Cold Spring Dyeing and Finishing Co.	400,000
		Silk finishing.		

Tenant (Multiple Occupancy) Manufacturing Plants

*July	8	Baltimore, Md.	General Index Manufacturing Co., etc.	283,000
		Index card manufacturing, electric lamps, and lamp shade assembly and wholesale paper products storage and sales.		
Sept.	3	New York, N. Y.	Vita-Fresh Co., etc.	258,000
		Cattle and dog food manufacturing and packaging tapes.		

Woodworking, Saw and Planing Mills

*Feb.	1	Los Angeles County, Calif.	A. K. Wilson Lumber Co.	375,000
		Sawing, planing, and drying of lumber, redwood siding.		
*May	2	Vancouver, B. C.	Evans Products, Northern Timber Co.	250,000
		Sawmill and lumber yard.		
May	6	Springfield, Ore.	M. & M. Woodworking Co.	320,000†
		Sawmill.		
*May	27	near Coeur d'Alene, Idaho	Atlas Tie Company	250,000
		Saw and planing mills and railway ties.		
*June	2	Priceville, Que.	Price Brothers & Co. Ltd.	422,000
		Sawmill, shingle mill, and chip mill.		1 killed
*June	15	McNary, Ariz.	Southwest Lumber Mills	1,402,000†
		Originated in mill; spread to other structures and forest.		
*July	3	Honeymoon Bay, B. C.	Western Forest Industries, Ltd.	1,065,000†
		Saw, planing, and shingle mills.		
July	5	Tahsis, B. C.	Gibson Mills, Ltd.	309,000
		Sawmill.		

Woodworking, Wood Products

*Feb.	25	Los Angeles, Calif.	Hollywood Door and Mill Co., etc.	1,000,000
		Originated in sash and door plant and spread to lumber yard, ice company, salvage storage yard, cosmetics plant, garage, and dry cleaning plant.		
*April	23	Bridgeport, Conn.	Cilco Terminal Co., etc.	714,000
		Lumber mill and assembly of prefabricated wood cottages.		
May	15	Portland, Tenn.	Strawberry Crate Co.	250,000
		Manufacture of cheese boxes, fruit and vegetable crates.		
*Aug.	14	Paducah, Ky.	Paducah Box and Basket Co.	250,000
		Box and basket factory.		
Aug.	27	Rhinelander, Wisc.	Robbins Flooring Co.	443,000
		Wood flooring.		
Sept.	1	Burton Township, Mich.	Mobile Trailer Co.	300,000
		House trailers.		
*Sept.	12	Cassopolis, Mich.	Terra Cruiser Co.	275,000
		House trailers.		

Woodworking, Wood Treating

July	3	Sioux Lookout, Ont.	Dominion Tar and Chemical Co.	250,000
		Creosoting of ties and timbers.		

Total (Manufacturing) $49,967,500
61 killed

MISCELLANEOUS

Aircraft Hangars				
Feb.	20	Deming, N. M. Twelve aircraft and hangar.	Skytel Airport	$300,000
Mar.	8	Glasgow, Mont. Seventeen aircraft and hangar.	Glasgow Airport	300,000
*June	10	St. Joseph, Mo. Seventeen aircraft and hangar.	Rosecrans Field	300,000
July	10	Teterboro, N. J. Fifty-six aircraft and hangar.	Teterboro Air Terminal	500,000
Sept.	9	near Amarillo, Texas Two aircraft, 17 motor vehicles, aircraft spare parts, used office furniture and hangar.	U. S. Bureau of Reclamation, etc.	320,000
Oct.	15	Quonset Point, R. I. Aircraft engine repair and overhaul hangar and contents.	U. S. Naval Air Station	2,000,000
Bowling Alley				
Jan.	31	Menands, N. Y. Bowling alley and grill.	Menands Recreation Center	350,000†
Churches				
Jan.	20	Quincy, Mass.	Sacred Heart Church	335,000
Feb.	1	Schenectady, N. Y.	First Reformed Church	335,000 1 killed
*Feb.	13	Danville, Pa.	Christ Episcopal Church	300,000
Mar.	19	Knoxville, Tenn.	Deadrick Avenue Baptist Church	250,000
April	2	Kamouraska County, Que.	Ste. Anne de la Pocatiere Church	250,000
Oct.	8	Kansas City, Mo.	Temple Baptist Church	255,000
Nov.	1	Montmagny, Que.	Montmagny Roman Catholic Church	750,000
Country Clubs				
April	18	Lyndhurst, Ohio	Mayfield Country Club	250,000
June	8	Los Angeles, Calif.	Hillcrest Country Club	275,000 1 killed
July	19	Des Moines, Iowa	Wakonda Club	366,000
Dec.	22	Lakewood, Colo.	Lakewood Country Club	263,000
Forest Fires				
June	7	Bourgmont Chassigne, Que. Forest fire and pulpwood pile.	E. Sousy et Fils, Ltd.	275,000
Sept.	12	Wheelers Hot Springs, Calif. Fifteen thousand acres of timber, 17 dwellings, orchid farm, etc.	Conflagration	1,000,000
Nov.	4	Topanga County, Calif. Brush fire spread through 3,155 acres of watershed and destroyed 37 dwellings and damaged 12 others.	Conflagration	585,000
Garages				
Jan.	22	Chester, Pa. Thirty-two buses, six service trucks, and garage.	Southern Pennsylvania Trans. Co.	780,000
*Sept.	3	Riverton, Wyo. Started in garage, destroying 37 motor vehicles and spread to warehouse, containing building materia's and furniture.	U. S. Bureau of Reclamation	300,000
Laundry				
Mar.	4	New York, N. Y. Fire in laundry spread through common cockloft to adjoining warehouse section. Valuable paintings destroyed.	Oak Laundry, Inc., etc.	250,000
*Dec.	9	Clarksdale, Miss. Started in laundry and dry cleaning plant. Spread to household and automotive equipment supply house.	Success Laundry, etc.	275,000

Lumber Yards

*April	8	Marysville, Calif.	Diamond Match Co., etc.	250,000
		Lumber yard, four dwellings, church, plumbing shop.		
*May	16	Vernon, Calif.	E. J. Stanton & Son Lumber Co.	760,000
		Three lumber storage sheds and adjoining lumber yard.		
*June	6	New York, N. Y.	Stewart Lumber Co., etc.	250,000
		Two lumber yards, diner, and yard-stored cable reels.		
Oct.	31	Oakland, Calif.	White Bros. Hardwood Lumber Co.	260,000
		Hardwood lumber storage shed and kiln.		
*Dec.	18	Coldwater, Mich.	Legg Lumber Co., etc.	250,000
		Lumber storage, coal yard, auto salesroom and wallpaper store.		

Mining Property

*Feb.	22	near Providence, Ky.	Low Moisture Coal Co., Inc.	250,000
		Coal mine surface property-power plant, tipple, rescreening plant, etc.		
*Dec.	11	Bauxite, Ark.	Reynolds Mining Co.	250,000
		Shop-garage and warehouse for tools and supplies.		

Unclassified

April	27	New York, N. Y.	Civil Aeronautics Authority	600,000
		Grass fire spread to radar station.		
May	31	So. St. Paul, Minn.	St. Paul Union Stockyards Co., etc.	1,000,000
		Stockyard (barns, pens, runs, etc.), 88 cattle cars, and trackage.		
*June	4	St. Victor de Tring, Que.	Conflagration	250,000
		40 buildings destroyed—35 dwellings, convent, stores, etc.		
June	27	near Bay St. Louis, Miss.	State of Mississippi	400,000
		3,362 feet of wooden highway bridge over water.		
*Oct.	3	Old Orchard Beach, Me.	Seashore Amusement Co., etc.	300,000
		Congested combustible amusement buildings.		
Nov.	19	near Seymour, Ind.	Texas Eastern Transmission Corp.	1,400,000
		Explosion of natural gas released from 24-inch pipe line.		
Dec.	16	Wheeler Ridge Cutoff, Calif.	Cattani Cotton Gin	868,000
		5,104 bales of yard-stored cotton, completely destroyed.		1 killed

Petroleum Production and Distribution

*Jan.	28	Cicero, Ill.	Certified Core Oil and Mfg. Co.	300,000
		Yard fire at tank farm spread to wood drum storage platform and thence to oil storage tanks.		
*Feb.	11	Toronto, Ont.	British-American Oil Co.	376,000
		One fuel oil truck, 4 refinery buildings (with contents including records), fourteen 10,000-gallon tanks containing fuel oil and alcohol, and hundreds of drums of petroleum by-products.		
*May	15	Glenwood Springs, Colo.	Rose Motor Co., etc.	275,000
		Tank truck overflow ignited and fire spread to two bulk oil plants and a railroad freight depot.		
*June	26	Louisville, Ky.	Ætna Oil Co.	250,000
		29 above-ground storage tanks at refinery.		
*July	12	Chambersburg, Pa.	Pryors Service Station, etc.	300,000
		Gasoline service station and farm implement store.		
Sept.	6-9	Leduc, Alta.	Alberta Natural Gas and Petroleum Conservation Board	500,000
		Wild oil well burned for three days.		

Piers

Jan.	6	New York, N. Y.	New York Dock Co., etc.	827,000
		575-foot combustible pier and shed, freighter and three barges.		
Aug.	3	Longview, Wash.	Weyerhaeuser Timber Co.	853,000†
		1,750-foot timber wharf and 3,000,000 board feet of lumber.		

Public Building

Jan.	20	Urbana, Ohio	Champaign County Court House	250,000
		Offices of county officials and court rooms.		

Schools

Feb. 12	Ithaca, N. Y. High voltage laboratory.	Cornell University	581,000
Mar. 27	Shawnee, Okla. High school and Manual Arts Building.	Shawnee High School	263,500
April 5	Herrin, Ill.	Herrin Township High School	250,000
April 7	Weston, Mass.	Weston High School	250,000
May 15	Baldwin, Fla.	Baldwin High School	250,000
May 31	Pittsburgh, Pa. Chemistry laboratory.	University of Pittsburgh	435,000
July 21	Vancouver, Wash.	Ogden Meadows High School	827,000
Aug. 29	W. Louisville, Ky.	W. Louisville Elementary and High School	274,000
Sept. 17	near Atlanta, Ga. Elementary school.	Rivers School	275,000
Oct. 20	State College, Miss. Classrooms and administration offices.	Mississippi State College	250,000
Nov. 11	Bryn Athyn, Pa. Church school—classrooms, laboratories and offices.	Academy of the New Church	450,000
		Total (Miscellaneous)	$26,288,500 3 killed

WAREHOUSING

Builders' Supplies

*June 8	Sioux Falls, S. D. Plumbers' supplies. Originated in box car on siding.	A. Y. McDonald Mfg. Co.	$565,000†
Oct. 17	Indianapolis, Ind. Used builders' supplies.	Cleveland Wrecking Co.	250,000

Chemicals

Feb. 15	East Hanover Township, N. J. Perfume oils, alcohol, flavoring oils, glycerine, turpentine.	Norda Essential Oil Co. (Seventeen Cosmetic Co.)	1,000,000
*May 29	Kansas City, Mo. Chemicals and oils, including stannic oxide, wood ash, sulfur, soda ash, salt cake, hydrated lime, methyl alcohol, anhydrous ammonia, etc.	Superior Chemical Co., etc.	447,000

Cotton

Sept. 21	Kaufman, Texas 1,637 bales of cotton.	Kaufman Compress Co.	425,000

Electrical Appliances and Equipment

Feb. 10	Des Moines, Iowa Radios, stoves and other electrical household supplies. Linoleum.	A. A. Schneiderhahn Co.	293,500
April 1	Boston, Mass. Electrical household appliances, wiring, and conduit.	Westinghouse Electric Supply Co.	275,000
*Aug. 19	St. Louis, Mo. Refrigerators, air conditioning equipment, washing machines, water heaters.	General Motors Corp. (Frigidaire Sales Corp.), etc.	758,000†
Nov. 6	Toledo, Ohio Electrical supplies and appliances.	Toledo Appliances Co.	275,000†

Food

Jan. 15	Stockton, Calif. Warehouse of fruit and vegetable cannery.	Flotill Products Co.	1,000,000
Feb. 20	Pittsburgh, Pa. Warehouse and bakery.	Atlantic and Pacific Tea Co.	250,000

June	24	Philadelphia, Pa.	Philadelphia Warehousing and Cold Storage Co.	1,115,000
		Orange juice concentrate and other foods in cold storage.		
Sept.	24	Oakland, Calif.	Fruitvale Canning Co.	340,000
		Apricots, peaches, fruit cocktail.		
Oct.	8	near Durham, N. C.	Colonial Food Stores	2,260,000
		Canned and perishable wholesale groceries.		
Fur				
Oct.	23	Arlington, Mass.	Bayburn, Inc.	300,000
		Cold storage vault for customers' fur garments.		
Furniture				
Aug.	3	Denver, Colo.	Davis and Shaw Furniture Co.	360,000
		New furniture.		
Glass				
Mar.	8	near Polo, Ill.	Chicago Apparatus Co.	276,000
		Scientific instruments for schools.		
Grain, Seed, etc.				
Jan.	3	Elkton, Mich.	Wallace and Morley Co.	391,000
		Grain elevator; grinding, feed mixing.		
July	8	Baltimore, Md.	Wm. G. Scarlett & Co.	472,000
		Feed and seed warehouse.		
July	8	Mascoutah, Ill.	Postel Milling Co.	275,000
		85,000 bushels of wheat in elevator.		
Sept.	16	Jerome, Idaho	Colorado Milling and Elevator Co.	743,000
		20,000 bushels of grain and 90,000 bags of beans.		
Nov.	9	Kansas City, Mo.	W. J. Small Co.	300,000
		Alfalfa meal storage.		
*Nov.	10	Spirit River, Alta.	Alberta Pool Elevators, etc.	480,000
		Grain elevator and pulpwood pile.		
*Nov.	30	Kelim, Colo.	Denver Elevator Co.	400,000
		Wheat and barley elevator.		
Hardware, Machinery, Metal				
Jan.	12	Buffalo, N. Y.	War Assets Administration	300,000
		War surplus machinery.		
Jan.	14	Ottumwa, Iowa	Sears, Roebuck & Co., etc.	265,500†
		Farm supplies storage.		
Jan.	25	Tecumseh, Mich.	Clinton Machine Co., etc.	325,000
		Gasoline motors. Coasters and wagons.		
*Jan.	26	Harrison, N. J.	Worthington Pump & Machinery Co.	1,290,000
		Pumps, machinery, and castings. Office building.		
May	11	Detroit, Mich.	Regal Motor Products	444,000
		Hardware and automotive supplies.		
June	1	Lexington, Ky.	Wombwell Automotive Parts Co.	256,000†
		Automotive supplies.		
July	9	Cleveland, Ohio	United States Steel Supply Co.	350,000
		Stock steel.		
Leather				
Jan.	15	Boston, Mass.	J. K. Mosser Leather Corp.	1,095,000
		Shoe leather.		
April	14	Detroit, Mich.	Chicago Rawhide Co.	351,000
		Storage and packaging of oiled leather.		

Multiple Occupancy

Jan.	21	Washington, D. C.	United States of America, etc.	270,000
		Furniture, lumber, office supplies, autos. Tenant manufacturing.		
Jan.	23	New Orleans, La.	Crescent Leather Supply Co., etc.	300,000
		Storage and sale of leather goods, stationery, drug supplies. Pants factory.		
Feb.	4	Fort Madison, Iowa	Ray Rump Grocery Warehouse, etc.	257,000
		Groceries and fountain pens.		
Mar.	1	Detroit, Mich.	Malden Paper Products Co., etc.	290,000
		Waxed paper, groceries and construction materials.		
Mar.	16	Manchester, N. H.	Silver Bros., Inc., etc.	253,000
		Grocery storage. Manufacture of upper leather splits. Other tenants.		
Sept.	16	Windsor, Ont.	Canadian Pacific Railway	250,000
		Newsprint, electrical equipment. Canned goods in nine freight cars.		
Dec.	29	Idaho Falls, Idaho	Western Potato Co., etc.	300,000
		Potato storage, sorting; rock wool, furniture, telephone equipment, etc.		

Terminals

Jan.	15	Chicago, Ill.	Roosevelt Cartage Co.	250,000
		Truck freight terminal and warehouse, trucks.		
Jan.	19	San Bernardino, Calif.	Santa Fe Railroad	250,000
		Railway freight house and office.		
Feb.	4	Columbus, Ohio	Retail Merchants Delivery, Inc.	688,000
		Truck terminal and repair shop. Eighty-two loaded local delivery trucks and stored merchandise destroyed.		2 killed
*Feb.	5	Cleveland, Ohio	Interstate Motor Freight System	554,500
		Truck terminal, two trucks, 14 trailers, and 2-story office building.		
April	17	New York, N. Y.	Eastern Transportation Co., etc.	286,500
		Truck terminal. Thirty trucks loaded with groceries and refrigerators.		
*April	24	Clinton, Mass.	Clinton Auto Express Co., etc.	250,000
		Truck terminal. Spread to two buildings used for manufacture of asphalt composition exterior wall coverings.		
June	5	Lowell, Mass.	Dana Trucking Co., etc.	356,000
		Truck terminal. Bolts of wool cloth.		
*Aug.	23	Montreal, Que.	Canadian National Railways	2,000,000
		Railway freight terminal. Storage sheds, freight cars and contents.		
Dec.	24	Montreal, Que.	Victoria Pier	400,000
		Truck terminal. Large area shed and 72 loaded trucks destroyed.		
Dec.	30	Miami, Fla.	Colonial Transfer Co.	400,000
		Truck garage and miscellaneous freight, including cleaning fluids, matches, electrical equipment, canned milk, etc.		

Tobacco

*May	13	Janesville, Wisc.	Liggett-Meyers Tobacco Co., etc.	299,000
		Principally stem tobacco with small amount of farm machinery. Spread to building used for new furniture storage, beer distributor and metal goods storage.		

Wool

April	2	Kerrville, Texas	Schreiner Wool and Mohair Co.	267,000
		Mohair and wool.		

Total (Warehousing) $25,848,000
2 killed

MERCANTILE PROPERTIES

Department Stores

Feb.	9	Goldsboro, N. C.	Weil's Department Store	$475,000†
Feb.	14	Trenton, N. J.	Binder's Department Store	250,000
*Feb.	16	Durango, Colo.	Durango Mercantile Co.	615,000†
		Wholesale and retail general merchandise and warehouses.		

Department Stores (Cont'd)

April	10	Los Angeles, Calif.	May Department Store, Inc.	250,000†
May	2	Springfield, Ill.	John Bressmer & Co.	1,650,000
*Aug.	19	Miami, Okla.	Millner-Berkey, etc.	352,000
		Originated in department store and spread to adjacent mercantiles.		
Sept.	27	Waco, Texas	J. C. Penney Company	360,000
*Dec.	1	Eau Claire, Wisc.	Sears, Roebuck & Co., etc.	250,000
		Originated in basement of department store and spread to adjoining drug store.		
*Dec.	6	Fremont, Ohio	Joseph's Department Store	910,000† 1 killed
Dec.	14	Windsor, Ont.	Adelman and C. H. Smith Co.	700,000
		Fire damage to Adelman's and heavy smoke damage to adjoining store.		
Dec.	21	Scottsbluff, Neb.	J. C. Penney Company	275,000

Drug Stores

*Feb.	21	Ocala, Fla.	Bennetts Drug Store, etc.	250,000
		Originated in rear of drug store (offices on second floor) and spread to adjoining F. W. Woolworth Company store.		
*July	31	Festus, Mo.	Klein Drug Store, etc.	250,000†
		Originated in drug store and spread to adjoining Morris Goldman Department store.		

Five Cent to $1.00 Stores

Jan.	23	Hempstead, N. Y.	Fisher-Beer Co., Inc.	509,000†
		Extensive water and smoke damage to exposures.		

Furniture Stores

*Feb.	10	Trenton, N. J.	New Jersey Floor Covering Co., etc.	250,000 1 killed
		Originated in household furniture, rug, and linoleum store under repair from previous fire and spread to the D. Wolff Furniture Co.		
Mar.	13	Logan, W. Va.	Lewis Furniture Co.	252,000†
*April	14	Laramie, Wyo.	Holliday Furniture Store, etc.	1,300,000
		Originated in furniture company and spread to destroy nine buildings and partially damage eleven others.		
*June	4	Duluth, Minn.	Rudolph Furniture Co., etc.	1,119,000†
		Originated in furniture store and spread to destroy two buildings and partially damage four others, including a fire-resistive office building.		
Aug.	18	Piqua, Ohio	Elliott Building	250,000
		Originated in basement of furniture store and spread vertically to destroy lodge hall above.		
*Nov.	12	Richmond, Va.	Rountree's Furniture Co., etc.	400,000
		Originated in furniture store and spread to adjacent Masonic Temple through exposed windows.		

Grocery Store

Mar.	12	near El Monte, Calif.	Crawford's Market	256,000
		Destroyed 65,000 sq. ft. single area grocery store.		

Hardware Store (including Automobile Supplies and Radio Stores)

Jan.	31	San Francisco, Calif.	Brunton's Automotive Supply Co.	374,000†
		Retail sales of automobile parts and accessories.		
May	14	Duluth, Minn.	S. & S. Auto Parts Co.	446,000†
		Wholesale, retail sales of automobile parts and accessories.		
June	17	Lowell, Mass.	Middlesex Supply Co.	250,000
		Large hardware supplier, radios, television sets, rugs, furniture.		

Multiple Occupancy (more than one tenant):

Feb.	6	Cuyahoga Falls, Ohio.	Falls Hardware Co., etc.	250,000
		Hardware and confectionery stores, offices and lodge rooms above.		

Multiple Occupancy (Cont'd)

Feb. 20	Pittsburgh, Pa.	Jackson Building	250,000
	Office building with drug store and optical shops on ground floor. Fire originated in basement of drug store.		2 killed
*Mar. 25	Berthierville, Que.	Quebec Liquor Commission, etc.	500,000
	Liquor store, general store, restaurant, offices, and apartments.		
April 18	Omaha, Neb.	Morris Paint and Varnish Co., etc.	348,000
	Paint and wallpaper store, automobile accessories, hardware, electrical appliances, sporting goods, etc.		
May 15	San Francisco, Calif.	United Automotive Supplies Co., etc.	466,000
	Automobile parts store, and cosmetics and soap supply house.		1 killed
*June 9	Rising Star, Texas	Higginbotham Bros., etc.	300,000
	Originated in mercantile warehouse and funeral home and spread to destroy a general merchandise store and 6 other buildings.		
*Aug. 4	Kalispell, Mont.	Koppang Building	290,000
	Started in jewelry store, spread to cafe, bar, and neon sign company.		
Sept. 10	Calgary, Alta.	Canadian Fairbanks-Morse Co., Ltd., etc.	410,000
	Originated in office of wholesale scale store and warehouse and spread to electrical supply and machinery company.		
Dec. 12	Cambridge, Mass.	Cyprus Hall	250,000
	Multiple mercantile stores on first floor with dance hall above.		
*Dec. 25	Humboldt, Iowa	Jensen's Paint Shop, etc.	350,000
	Stores on first floor, apartments above.		

Restaurant

Nov. 9	Los Angeles, Calif.	Eaton's Rancho Cafe	290,000†

Stationery Store

Feb. 15	Kalamazoo, Mich.	Doubleday Bros. & Co.	253,000
	Office supplies and equipment with printing.		

Total (Mercantile)	$15,950,000
	5 killed

TRANSPORTATION

Aircraft (excluding high impact accidents where fire was neither responsible for the accident nor the deaths which followed):

Jan. 21	Boston, Mass.	Eastern Air Lines "Constellation"	$850,000
	Fire destroyed the aircraft after it struck a snowbank following a normal instrument landing at Logan Airport.		
Mar. 10	Chicago, Ill.	Delta Air Lines DC-4	400,000
	Aircraft crashed and burned after stalling at 600 ft. soon after take-off.		12 killed
Mar. 11	near Donaldsonville, La.	U. S. Navy C-54	400,000
	A Navy C-54 crashed and burned at a fog-shrouded auxiliary airport following mid-air propeller failure.		
Mar. 18	near Tampa, Florida	U. S. Air Force B-29	750,000
	Aircraft crashed while landing at Macdill Field in dense fog.		10 killed
June 5	near Muroc, Calif.	U. S. Air Force YB-49	1,000,000
	An experimental "Flying Wing" jet bomber crashed on the Mojave Desert during a test flight.		5 killed
July 17	Mount Carmel, Pa.	United Air Lines DC-6	1,100,000
	Plane crashed and burned on a hillside near Mount Carmel, killing all on board. The loss estimate includes $350,000 insurance payments.		43 killed
Aug. 12	Sydney, Nova Scotia	Trans-Canada Air Lines DC-4M	500,000
	Eleven passengers and six crew members escaped safely after aircraft's undercarriage struck a small rock pile following a normal landing.		
Aug. 12	near Topeka, Kansas	U. S. Air Force B-29	750,000
	This B-29 crashed shortly after take-off.		5 killed
Aug. 12	near Roswell, N. M.	U. S. Air Force B-29	750,000
	Crash occurred soon after take-off from the Walker Air Base in open uninhabited country.		13 killed

Aircraft (Cont'd)

Aug. 20	near Rapid City, S. D.	U. S. Air Force B-29	750,000
	Fire in one engine at a crucial moment during take-off.		17 killed
Aug. 24	Honolulu, T. H.	U. S. Air Force B-29	1,000,000
	Aircraft crashed during emergency landing, striking grounded transport plane and a power station.		16 killed
Sept. 20	near Alpaugh, Calif.	U. S. Air Force B-45	1,000,000
	This jet bomber crashed and burned just outside the city.		2 killed
Sept. 28	New York, N. Y.	Trans-World Airlines DC-4	337,500
	A fire developed during oxygen servicing and destroyed the fuselage.		
Sept. 28	Shemya Island, Alaska	U. S. Air Force B-29	750,000
	Aircraft crashed after engine failure during landing.		3 killed
Oct. 6	near Waycross, Ga.	U. S. Air Force B-29	750,000
	Fire in one powerplant of a B-29 was followed by a mid-air explosion.		9 killed
Nov. 13	near Fairbanks, Alaska	U. S. Air Force B-50	1,500,000
	C-47 crashed on take-off into a B-50 at Ladd Field, Alaska.		6 killed
Nov. 25	Los Angeles, Calif.	Transcontinental and Western Airlines	850,000
	Eighteen passengers and five crew members safely escaped from a burning TWA Constellation at the Los Angeles Municipal Airport.		

Marine Vessels

Jan. 12	At sea (Atlantic Ocean)	U. S. A. T. *Joseph Connolly*	6,000,000
	Vessel totally destroyed at sea with complete loss of cargo of coffins valued at $4,500,000.		

Railroad Rolling Stock

Nov. 11	near Fruitland, Ala.	Gulf Mobile and Ohio R. R.	250,000
	36 loaded box and tank cars destroyed and trestle damaged by fire.		
Nov. 15	Renault, Ill.	Missouri Pacific R. R., etc.	400,000
	Diesel locomotive, 10 loaded and 4 empty box cars destroyed and other cars damaged in fire following derailment.		

Total (Transportation) $20,087,000
141 killed

HABITATIONAL

Dwelling

Feb. 2	near Radnor, Pa.	A. J. Drexel Paul	$250,000

Hospital

Mar. 10	Asheville, N. C.	Highland Hospital	300,000
	Hospital for mental patients.		9 killed
Nov. 19	Sardis, B. C.	Coqualeetza Indian Hospital	500,000
	Hospital for tuberculosis patients.		

Hotels

*Jan. 22	Ste. Marguerite Sta., Que.	Roney Terrace Hotel	500,000
	Newly completed resort hotel and cottages.		
Jan. 30	St. Albans, Vt.	Jesse Welden Inn	250,000
	75-room, 136-year-old occupied hotel.		3 killed
Feb. 21	Mt. Arlington, N. J.	Alamac Hotel	403,000
	Nonoperating seasonal hotel, 250 rooms.		
Mar. 20	St. Jerome, Que.	Hotel Lapointe	390,000
	Occupied hotel with 53 guests at time of fire.		
June 14	Sheffield, Ala.	Sheffield Hotel	375,000
	61-year-old occupied hotel, 163 rooms.		
July 11	Santa Monica, Calif.	Del Mar Hotel	388,000†
	Beach club and hotel.		

Total (Habitational) $3,356,000
12 killed

Table No. 22

OTHER REPRESENTATIVE LARGE LOSS FIRES

Jan. 6	LeBourget, France	Air France	$450,000
	Aircraft (DC-4) crashed and burned while coming in for landing.		15 killed
Jan. 30	Paris, France	Compagnie des Entrepots et Magasins	5,000,000
	Heavily stocked warehouse containing American-French relief food, furniture, bedding, clothing, etc., totally destroyed.		
Mar. 2	Adelaide, Australia	Charles Moore & Co.	863,350
	Department store totally destroyed. Fire in unsprinklered blind attic overpowered sprinklers in balance of structure.		
April 1	Sydney, Australia	Dept. of Trade and Customs	1,336,000
	14,467 bales of cotton destroyed in large unsprinklered warehouse.		
April 15	Shannon, Eire	Pan-American Airways	850,000
	Thirty persons were killed when a Lockheed "Constellation" crashed and burned near Shannon Airport during an instrument landing.		30 killed
May 22	Buenos Aires, Argentina	Sociedad Comercial Israelita, S. A.	1,500,000
	A large area, unsprinklered warehouse storing goods for export to Israel was destroyed. Poor structural conditions and inadequate public protection were factors in the loss.		
June 22	near Bombay, India	Isthmian Steamship Line	250,000
	Flames swept the American freighter *Steel Flyer* at anchor 5 miles from the Bombay piers. A 6,000-ton general cargo was destroyed and the ship considerably damaged.		
June 25	Fukui, Japan	Conflagration	Not estimated
	Fires following earthquake caused 1,500 fatalities and the destruction of 2,371 buildings. (See Oct. 1948 QUARTERLY, page 83.)		1,500 killed
July 28	Ludwigshafen, Germany	I. G. Farben Industrie	15,000,000
	A tank car containing dimethyl ether exploded and 14 buildings of this large chemical plant were destroyed, 240 killed and 600 seriously wounded. (Preliminary information.)		240 killed
Aug. 8	Shanghai, China	Yung Pi (Shirt Factory)	Not estimated
	Lightning is blamed for this fire which killed 63 employees.		63 killed
Aug. 13	Berlin, Germany	U. S. Air Forces	450,000
	Aircraft (C-54) crashed and burned at Tempelhof Airdrome after overshooting the runway following an instrument landing.		
Sept. 11	Amsterdam, Holland	Blaauvries Cold Storage Warehouse	Not estimated
	A large area cold storage warehouse on an Amsterdam dock was heavily damaged by a fire which destroyed stored foodstuffs.		
Sept. 22	Hongkong, China	Wing On Oil Co.	4,000,000 est.
	A severe explosion in a warehouse is said to have caused 140 deaths in the structure and an adjacent tenement.		140 killed
Oct. 6	Copenhagen, Denmark	S.S. *Takoradian*	1,575,000
	British freighter *Takoradian* (10,000 tons) burned at Islands Brygge while unloading a cargo of palm kernels. Loss to cargo is estimated at $840,000 and to the ship at $735,000.		
Oct. 11	Manila, P. I.	Philippine Educational Co.	2,000,000
	Preliminary reports indicate that three American business houses were destroyed by fire. Official reports are not available.		
Oct. 21	Prestwick, Scotland	Royal Dutch Airlines	850,000
	A KLM "Constellation" crashed and burned after hitting a high tension wire about 1,200 ft. off the end of the runway. The impact opened integral fuel tanks and the aircraft caught fire in the air.		39 killed
Nov. 28	Mexico City, Mexico	Ferreteria La Sirena, S. A.	630,000
	Eleven firemen and one civilian were killed when building collapse followed fire in a hardware store.		12 killed
Dec. 7	Santiago, Chile	School of Medicine	3,000,000
	Fire destroyed the laboratories and library of the school.		
Dec. 7	Sydney, Australia	Tin Box Factory	1,600,000
	Newspapers report that fire destroyed a 2½-acre tin box factory.		
Dec. 12	Antofagasta, Chile	Peruvian International Airways	450,000
	Fire followed tire failure when a DC-4 landed. Seven of fifteen occupants were injured.		

Public Water Supplies for Fire Fighting

By John West (Member NFPA)
Associated Factory Mutual Fire Insurance Companies

Those of us who have had the opportunity of attending recent conferences in Washington, including the NFPA sessions, are conscious of the publicity which has been given to the current needs of the public fire departments, the agitation for the general adoption of workable building codes, and the progress which is being made in the installation of automatic sprinklers in institutions and other public buildings. We find that the NFPA committees are investigating all types of hazards and the equipment best fitted to control them. All this effort and publicity is very important in combating our steadily rising fire losses.

A relatively small group of fire protection men investigate water supplies for fire fighting. Some of us are constantly called upon to test and evaluate the public water supplies in cities and communities throughout a number of states. In many instances, we note that static pressures have dropped steadily over a period of years. For instance, in one high value industrial district the static pressure had averaged 75 psi. Today it is 45 psi. In another city, which has a reasonably good distribution system, the available pressures have been dropping steadily for five years. In a third city, industry is seriously handicapped by an acute water shortage. In a fourth city, an important central and water front district is plagued by dangerously low pressures.

Note: This article is based upon a paper presented by the author at the NFPA Northeastern Regional Meeting at Hartford, Conn., Oct. 29, 1948.

The examples cited include the capitals or principal cities in several Eastern states. In almost all cases those in charge of water supply attribute their problems to the steady increase in consumption which began with the war and has continued its upward trend with no sign of abatement. Contributing factors include obsolete and inadequate piping arrangements, the need of additional pumping equipment, as well as overtaxed sources of supply. It is well known that many of the systems in the older cities were designed to meet the needs of 50 to 75 years ago and improvements have not kept pace with increased consumption.

Presuming the problem to be national in scope, a spot check was made through the Factory Mutual Inspection Departments at Boston, Cleveland, Chicago, Charlotte, Philadelphia, New York City and San Francisco. From this spot check we received the names of 73 cities and towns in 20 states where there were deficiencies in pressures and/or acute water shortages. Reports from the Pacific Coast indicate that the water supplies for the major cities in that area are strong gravity systems. The military installations during the war produced a severe strain on some, but the need was so great that projects to correct the trouble were started at once so that by now conditions are improved or soon will be. Mention was made of the 80-mile extension of the Southern California Metropolitan Aqueduct which is nearing completion. This spot check supports the assump-

tion that the problem is national in scope and requires a thorough investigation.

The alarm which is reflected in this discussion is due to the many critical situations which undoubtedly will develop unless immediate steps are taken for improvements.

The American public takes its water supply for granted. It can see and appreciate shiny new fire equipment and painted fire hydrants on the corners, all of which contribute to a feeling of security. It does not see the tuberculated street mains, the overtaxed feeder lines, the lowered water levels in the reservoirs, or the inadequate pumps and filters. Too frequently, municipal and water company officials fail to advertise these deficiencies. When conscientious water officials propose bond issues for needed improvements, the complacent public often refuses to vote approval. Not until the deficiencies are demonstrated by failure to supply enough water for the control of fires or until water fails to reach the upper stories in the homes, or restrictions are placed on the use of water, is the public aroused sufficiently to demand action. By then conditions are truly critical. There is no quick remedy for most of these situations. Such conditions offer conflagration possibilities.

We have a report on a large midwest city where the maximum daily consumption is in excess of the planned capacity. In parts of the city the pressures hover around zero during the periods of peak demand. An investigation was made in 1944. Some improvements were authorized in 1945. A new intake from the lake, a new filtration plant and pumping station are now in construction, but will not be in service until 1950. Meanwhile the critical condition continues.

In another city in New Jersey, there was a shortage of water in the downtown district in 1940. The National Board of Fire Underwriters made an investigation early in 1941 and recommended additional feeder mains. The improvements were not authorized by the city officials. By 1946 conditions were critical. In 1947 the Manufacturers Association tried to encourage action. The following tests were made at an industrial plant in the affected area: On September 3, 1947, from 10 A.M. until 8 P.M. the maximum pressure varied between 8 and 15 lbs. On the same day in 1948 the pressure was 7 lbs. at 8 A.M. and by 11 A.M. it had dropped to zero, where it remained until 6 P.M., when it reached 2 lbs. with slow increase until 5 A.M. the next morning, when the normal maximum of 35 was reached. At this same plant, zero pressures were recorded from 5 to 8 consecutive hours on 7 days between August 31 and September 13. Newspapers report that the water commissioners have finally authorized the installation of additional feeders to the district, which should in part solve this distribution problem.

The point of interest in these two examples is the time delay which so frequently occurs between the exposing of the critical situation and the completion of the improvements. It is for this reason that where increasing consumption and falling pressures indicate a probable emergency, the time for action is now and not after the emergency arises.

Committees are investigating private water supplies, special extinguishing equipment, industrial hazards and the needs of the public fire departments, but in the fire protection publications which come to our attention there is little, if any, space devoted to public water systems, their condition and the special problems with which they are confronted.

Water from public systems continues to be the most important medium in the extinguishment of fires. The efficiency of the public fire departments is too frequently handicapped by deficiencies in the public water systems.

Theoretically the municipal government, elected by the people, is responsible for the maintenance of adequate water supplies for all purposes including fire. In some cases a private company is given the concession to supply water.

Leaving out of consideration any legal liabilities and considering only recognized standards for waterworks practice, it is an established fact that waterwork systems are designed to serve the dual purpose of supplying water for fire extinguishment as well as for domestic and industrial service. Therefore, there devolves upon the waterworks a moral, if not legal, obligation to make available a sufficient amount of water for general fire protection purposes.

Municipal as well as privately owned waterworks systems should be self-supporting and the income derived from the sale of water should pay operating and overhead cost, including the provision of sufficient reserve to offset depreciation. Too frequently in municipally owned systems the establishment of a depreciation reserve is neglected. With the steadily increasing use of water for industrial and domestic purposes, the cash available over and above that required for operation alone has become an attractive source of revenue which can be used for the reduction of general taxes. Thus funds which should have been used to offset depreciation are used for other than waterwork purposes to the detriment of the waterworks system. This is one of the principal reasons for the deficiencies in public owned waterworks systems. There are, of course, numerous contributing factors which an investigation would reveal.

Private water companies generally operate under franchises which grant them freedom from competition and the sole right to sell water within a fixed territory. Occasionally these franchises place unfair burdens on the water companies, such as limiting the return for general fire service or requiring free water to be furnished for municipal service, etc. Seldom, however, are these franchises specific as to their requirements for fire protection.

While it is in no way intended to imply that all water companies are indifferent to fire protection, it frequently happens, particularly with some of the smaller companies, that the provision of an adequate volume of water for such purposes is considered incidental to the sale of water for industrial and domestic purposes.

Due, at least in part, to the fact that accrued reserve funds are inadequate because of the increased cost of material and labor to provide needed improvements, to the reluctance to make capital investment which would require new rate schedules, and due to the desire to maintain dividend rates, many private systems have not been sufficiently improved to meet current requirements. In such systems we find distribution mains that are now totally inadequate in size and fire hydrants that are little, if anything, more than decorations.

To assure proper service many small towns have been forced to buy privately owned systems at today's inflated prices.

It is not our purpose to review all the factors which are involved in the maintenance of adequate water supplies, but the following items may be of special interest.

Many states regulate by law the indebtedness that a city or town may incur. Due to the presently high cost of govern-

ment many towns and cities have reached their debt limit and are unable to raise additional funds for public water improvements or to purchase decadent water companies. For example: The residents of one town in Pennsylvania are concerned about the inadequacy of the public water system, particularly for fire service, and the officials report that due to the present town debt, which is at the maximum prescribed by law, no improvement in the public water supply may be anticipated at least until after 1950.

To meet the need for large scale public improvements, Pennsylvania enacted a law known as the Municipality Authorities Act of 1945, superseding a similar act dated 1935. Under this act, a group of five citizens may act as a corporate body with powers to issue bonds, acquire property and rights, either by direct purchase or eminent domain proceedings for all types of public improvements, including waterworks, water rights, water systems, etc. The bonds must be liquidated within 40 years, after which the project, erected or acquired, reverts to the city or town. The bonds are tax free as is also the project.

Many municipal water authorities have developed under this act and have purchased private water companies at today's prices. In some cases where the local government is without an organized operating group, the authority has been forced to hire the original owners to supervise and operate the system on a fee basis. This has been a boon to many private water companies in the state which have been unable to render adequate service and have had difficulties, due to increased operating costs, in meeting their annual dividends and taxes.

Municipal authorities, although exempt from taxes and dividends, must pay the interest on the bonds, and the income from the water system must also be used to defray operating costs. The Chester (Pa.) Municipal Water Authority found it necessary to increase the water rates fifty per cent in order to assist in the provision of a new water supply. Other towns in Pennsylvania which are using this means of securing control of private water systems are Williamsport, Hazleton, Lehighton, Lansdale, Hatboro, and probably many others which have not reached our attention. It appears that this act is being used, in some cases, to circumvent the law limiting the amount of bonded indebtedness which may be incurred.

The laws of Pennsylvania will also permit municipal water departments to float bonds chargeable against these departments, independent of the general borrowing capacity of the city, provided that the water department operates at a profit, and even though the income from this department goes into the general fund. The inherent dangers of this practice were outlined in an editorial in one of the Philadelphia papers, early this year. This editorial stated that inflation is pushing Philadelphia into a position where an increase in water rates appears unavoidable. The water supply system was still self-supporting within the constitutional definition at the end of 1947, but the margin was only $200,000 a year. Further borrowing for water supply and pay increases for employees could easily wipe out this margin. What then? Then all outstanding water debt would suddenly become a charge against the general borrowing power and throw it into the red. The result would be that borrowing would not be possible for years for water, or the many other improvements in the city's program. Since the city dare not let this happen, there ap-

pears to be no practical solution but to increase the rates.

It is hoped that this discussion will provoke committee activity either within the NFPA or elsewhere, which will delve into the condition of public water systems throughout the country, will publicize its findings and will be able to develop methods of correcting deficiencies.

It appears that this investigation should probably include a complete review of waterworks economics; the feasibility of cleaning mains to give temporary relief; the universal use of metering devices to eliminate waste; the need of legislation to prevent excesive tapping of the water table by private users where the public supply is obtained from deep wells; and the effect of air-conditioning on water demands.

The National Board of Fire Underwriters has published fire flow schedules which are accepted by all fire protection groups and presumably are used in the determination of fire insurance rates. Perhaps the penalties for noncompliance could be made a more effective weapon for the maintenance of adequate water supplies for fire.

Who is to assume the responsibility for this public service?

Smallpox and Fires

R. D. MacDaniel,
Grain Dealers National Mutual Fire Insurance Co.

Most diners at the famous Patten restaurant in Boston are intrigued at the reproduction on its menu of a map of early Boston, made by Captain John Bonner in 1722.

Among the many interesting details are two columns of dates indicating disasters which, apparently, were considered of sufficient importance by the worthy Captain to warrant inclusion in this cartographic record. One of these contains the dates of the eight great fires which the city had experienced up to that time, beginning with that of 1653. The other column is a recording of six general smallpox epidemics, beginning with that of 1640, one of which covered a period of ten years.

That no longer are there epidemics of smallpox in Boston attests to the fact that progress has been made in that New England metropolis.

The experience of Boston has, of course, been no different than that of other centers of population — or, in fact, than that of the country as a whole. No longer do we experience devastating epidemics, but conflagrations continue with a regularity that is all but discouraging to those interested in fire-loss prevention.

However, if one is inclined to be discouraged at the continuance of our appalling, needless fire waste of both life and property, he should take heart in a reflection of just how much worse it might be — and undoubtedly would be were it not for the tremendous and far-reaching efforts that have been and are being made in the war against fire.

To appreciate just how far we actually have progressed one needs only to peruse some of the past publications of the National Fire Protection Association. In the October 1917 *Quarterly* may be found

excerpts from an article, from a then current issue of a nationally prominent women's magazine, delineating methods whereby the housewife could make repairs to or otherwise alter her gas piping and electric wiring. As to the former this statement is made: "If the pipes spring a leak, try and find it and with a homemade preparation of boiled linseed oil and white lead mixed to the consistency of a cement, apply to the crack. When this has hardened, test it by holding a lighted match near the leak. . . ." And in respect to the wiring: "If you have many standing lamps in the house, it is well to get a double socket set and have long wires running from them to the part of the room you wish to light. I sometimes run my wires along the baseboard and sometimes along the picture molding, and in this way I can run them clear around the room and they do not show until they drop to where the light is placed."

Again, in the October 1920 *Quarterly*, occurs this reprint from another, but equally prominent, magazine: "The chief reason for poor results (in home dry cleaning) is that the amateur cleaner is too economical with gasoline. . . . To get good results, not pints but gallons are necessary to carry on the processes of soaking, washing and rinsing. It is therefore necessary to save soiled garments for a wholesale cleaning day, for which one provides not less than three gallons of first-grade gasoline." Also included was friendly advice as to straining gasoline through chamois and storing it in bottles and cans, and a further suggestion that the home cleaning closet should contain alcohol, benzine and ether.

With advice of that nature being so freely dispensed as late as 1917 and 1920, it is little wonder that the American people are so prone to do things which result in loss of life and property. And just as this condition is the result of "learning"—from one source or another—to do those things, it is obvious the condition adequately can be changed only by a similar, but corrective, process of education.

Human traits are pretty difficult things to influence, whether the point at issue is a matter of overindulgence or of placing pennies behind fuses. To those of us for whom fire prevention is a dominating part of our work and to whom the seeming lethargy of the populace is likely to prove discouraging, Fire Prevention Week comes as a shot in the arm. For it is then that we again become conscious of ever-increasing popular interest as evidenced by the fine work of local and state committees — committees made up of men and women who appreciate the importance of minimizing the fire waste and are willing to give of their time and energy that this should come to pass.

Just as the scourge of smallpox has been "wiped off the map" in Boston, so some day the United States shall be free of its present disgraceful fire waste. The institution of Fire Prevention Week and the cooperation of all those good people who make possible its observance are major factors, slowly but surely influencing the trend toward that goal.

WHY Unsatisfactory Sprinkler Fires?

By H. E. Hilton, Executive Director
National Automatic Sprinkler and Fire Control Association

A record of 95.9% efficiency should be proof enough of the operating efficiency of any man-made mechanical device in service for over 50 years. This record in fire extinguishment and control has been established by automatic sprinkler equipment ever since 1897.* Such an achievement should allow the automatic sprinkler industry to sit back and reap the harvest of its own little marvel. Such complacency, however, is dangerous. Further, it can be shown that the 4.1% of "unsatisfactory sprinkler fires" can be reduced to the vanishing point *if* a few basic principles are adhered to by the industry itself, by insurance rating and inspection agencies, and, most important, by property owners and occupants.

The National Automatic Sprinkler and Fire Control Association is determined to make every possible effort to hit the 100% mark. We doubt, because we are practical business men, that this perfection will be achieved in full, but we are confident that we can improve the record and it is our purpose to do so. In this effort, we have enlisted the services of the NFPA engineering staff and anticipate the cooperation of all those interested in minimizing fire loss. This article presents the facts of 45 selected fires, involving sprinklered properties occurring during the period of January 1, 1948 to September 15, 1948. In that same period there were thousands of fires in sprinklered properties where sprinkler performance was 100% efficient. It has been prepared to stress the importance of correcting those conditions which are responsible for the losses occurring in sprinklered properties that such losses of both life and property may be reduced to a minimum in the future.

These 45 fires in sprinklered properties are all important fires. Sprinklered properties are most often high-valued industrial, storage or mercantile buildings possessing equally high-valued contents. Any substantial fire which is not controlled by a few sprinklers will almost invariably involve substantial loss and this becomes particularly self-evident when it is remembered that 75.9% of all fires in sprinklered properties reported to the NFPA since 1897 (71,519 cases) have been controlled by 6 or less operating sprinklers.

The 31 fatalities in this year's record are particularly disturbing, as safety to life is the primary purpose and function of sprinkler protection. It is only somewhat comforting to explain that 29 out of the 31 fatalities resulted from explosions of dust or vapors in 3 of the 45 fires and that only two deaths might be directly attributed to fire in a building protected by properly operating sprinklers.

The principal reasons responsible for the fire loss of these 45 fires are:

Hazard of occupancy too severe for sprinkler system designed only for ordinary hazard occupancies.....	9
Water shut off at start of fire.....	8

*See QUARTERLY, April, 1945.

Unprotected concealed spaces	5
Insufficient water supplies	4
Explosions wrecking sprinkler equipment	4
Partial protection, fire originated in unsprinklered portion	4
Improper maintenance, unskilled owner alteration, or faulty repair methods	4
Premature shutting off of water supplies	2
Frozen pipes or valves	2
Obstructed distribution	1
Floor collapse rupturing piping	1
Lack of exterior sprinklers to protect against exposure fire	1
Total	45

The significance of these contributing factors may best be emphasized by reviewing the fires critically with regard to the sprinkler operation, grouping them into the principal categories responsible for their lack of effectiveness.

Water Shut Off at Start of Fire

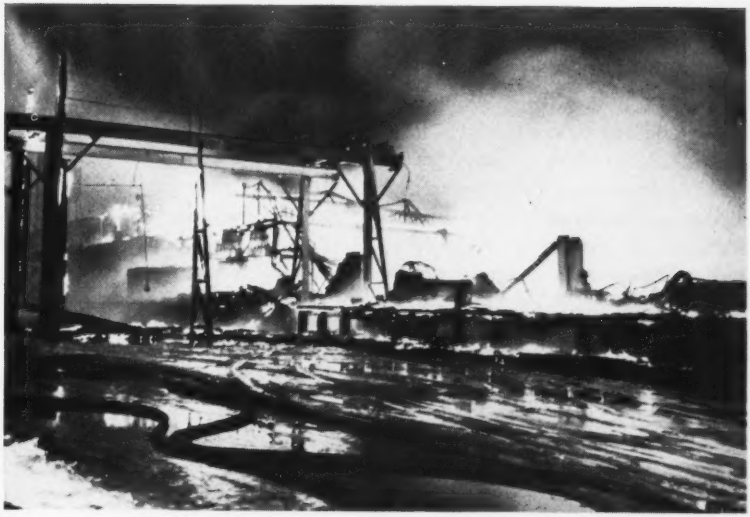
Eight serious fires in sprinklered plants occurred for the stupidly evident reason that the water was shut off at the start of the fire. In three cases the systems had been purposely discontinued by property owners because of the costs of maintenance and, in four other cases, the systems were temporarily shut off during alterations. In one instance, a control valve was unintentionally supervised closed instead of open.

The most outstanding fire in this group was the War Assets Administration warehouse loss of January 12 in Buffalo, N. Y. Full details of this fire were reported in the April 1948 QUARTERLY (page 285) but the following quotation bears repeating: "Property of the citizens of the United States valued conservatively at $1,000,000 was destroyed by fire because War Assets Administration officials in an ill-advised economy move decided to dispense with sprinkler protection during the winter months." The saving involved (expense of heating areas where piping was subject to freezing) was estimated at $8,000. This saving appeared "penny wise, pound foolish" when fire gutted one-half of the 1304 ft. by 886 ft. structure.

The other two cases where sprinklers had been purposely discontinued involved relatively small properties. A frame storehouse (49 ft. x 26 ft.) at the Thor Corporation plant, Newtown, Conn., and the center section of the National Plastic Products Co. property, Odenton, Maryland, were destroyed while installed sprinkler systems, lacking a drop of water, were a hollow mockery as flames devoured the buildings and contents.

Insurance dollars were paid and business interrupted at the Central Hardware Co. store in St. Louis, at the Portland Copper and Tank Works, South Portland, Maine, at the Eunice Rice Milling Company plant in Eunice, Louisiana, and at the Keyes Fibre Company at Hammond, Indiana, because inadequate precautions were taken during temporary shut-off of sprinkler systems undergoing alterations.

The hardware store fire broke out at 6:11 A.M. on a Sunday morning (Feb. 15) and was discovered by a passer-by only after it was well advanced. Sprinkler protection had been turned off in a 40 ft. x 40 ft. area in the rear of the store during some structural changes and the installation of new lighting fixtures in the basement. The balance of the store remained under protection. Fire damage was confined to the small unprotected area, but heat radiation up an unenclosed stairwell activated many sprinklers on the second floor of the 125 ft. x 45 ft. building.



Acme

Property of the citizens of the United States valued conservatively at $1,000,000 was destroyed in this fire at the War Assets Administration warehouse in Buffalo, New York, on January 12 because of an ill-advised economy move by the Government Agency to dispense with sprinkler protection during the winter months. Water shut-off at the start of the fire was also responsible for eight other large fires in sprinklered properties covered in this analysis.

Water damage was severe because these sprinklers operated for an unnecessarily long period prior to detection and because 13 major hose lines were required to extinguish the burning paints and oils in the unprotected area. The sprinkler contractor recognized the future need "to notify the Fire Department wherever any section of a sprinkler system is shut off overnight or during the week end" and also "the necessity of providing watchmen for such areas while sprinklers are out-of-service, especially when the values involved are considerable."

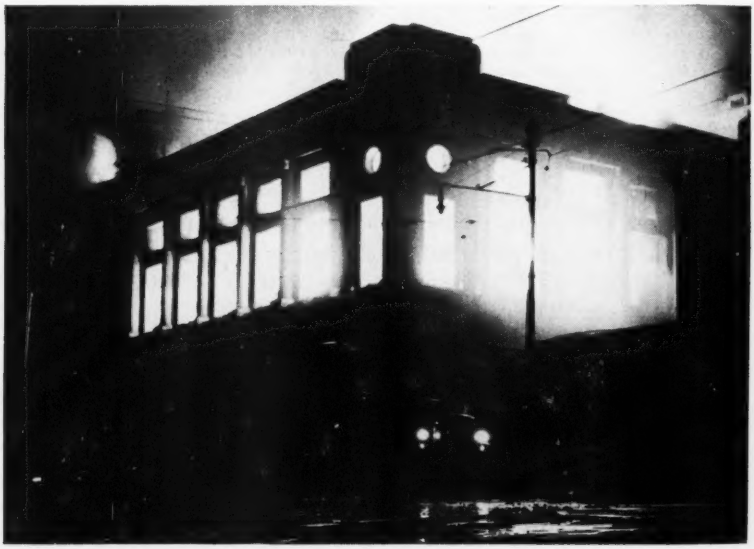
Positive evidence as to valve closure at the South Portland fire is not available. The supposition is that owner maintenance personnel who were making repairs on the system the previous day had failed to restore protection by opening the main control valve. Only effective manual fire fighting prevented total loss of communicating shop buildings of ordinary wood construction.

At the Eunice Rice Mill, a sprinkler contractor was making alterations and extensions to an existing system upon recommendations of an insurance inspector, and at 10:30 A.M. had completed the work with the exception of installing the automatic sprinklers themselves, which had not been delivered. Plugs had been inserted in the sprinkler outlets to permit tests being made and some of the valves had been closed. The fire occurred about 12:30 P.M. the same day and while employees heard "sprinkler heads popping like popcorn" and the sprinkler gong ring, no water flowed. The whole episode, resulting in a loss estimated at $100,000, serves to emphasize to sprinkler contractors the need to deliver all necessary ma-

terials for any alteration or extension of any existing system before protection is withdrawn.

The valve closure at the new plant of the Keyes Fibre Company in Hammond was particularly unfortunate when welding sparks ignited an estimated 500 tons of baled paper on April 5. The sprinkler contractor was given a day-work order to move a sprinkler main and the system was drained at 8:30 A.M. The change was to take approximately 1½ hours. Despite management knowledge of this temporary discontinuance, the welding work was permitted, and the fire broke out just 18 minutes later. It was impossible to put back sprinkler service and the fire had to be fought with hose lines by the public fire department. Some precious time was lost in bringing effective hose streams into action because yard hydrants were also "off" due to the valve closure at the street connection. The loss is estimated at $190,000.

An old style target indicating type valve controlling sprinklers at a fire-resistive, tenant occupied, industrial building on Guilford Avenue in Baltimore had been leaking. Maintenance men repacked the valve in October 1947 and left it in what they thought an open position and with the assistance of the central station supervisory agency, strapped it in that position. When a fire broke out in a woodworking tenant's finishing room on the second floor



The Advertiser (Adelaide, South Australia)—Krischock Photos

A concealed space between the top floor ceiling and the roof was the only area not protected by automatic sprinklers in the Charles Moore & Co. department store in Adelaide, South Australia. Fire originating in this area on March 2 was responsible for the total loss pictured above. Not detected for some time after origin, the flames had so weakened wood roof supports that a 20 ft. by 30 ft. section caved in, breaking top floor sprinkler lines within a very few minutes after fire equipment reached the scene. Strong winds and combustible stocks sent flames throughout the balance of the structure, overtaxing the remaining operating sprinklers.

at 6:55 A.M. on June 8, no water discharged from the sprinklers. A workman, who reported for work at 7:00, turned in a fire alarm from a box on the first floor and the Baltimore Fire Department extinguished the blaze with three 2½-in. hose lines. After the fire, it was found that 42 sprinklers had fused, but no water was available because of the unintentionally closed valve. The loss was estimated at $20,000.

These "shut-offs" indicate that the following steps should be taken:

(1) That the automatic sprinkler industry should make every effort to assure that installations of their equipment are kept in service.

(2) That automatic sprinkler contractors should maintain service to the maximum extent during alterations or repair of systems and that they should advise local fire departments as well as insurance underwriters when discontinuance is unavoidable. Where service must be withdrawn overnight special watchman service should be substituted.

(3) That insurance interests should be particularly vigilant to prevent unintentional water shut-offs through their inspection services to their assured.

(4) That property owners should discontinue any hazardous operations during temporary sprinkler service discontinuance or should post special fire watchmen where this is not possible. Property owners should also conduct their own valve inspections to assure continuity of protection.

Unprotected Concealed Spaces

Like a little boy with an inquisitive mind, give fire an inch and it will take a mile, figuratively speaking. This characteristic is pathetically illustrated in five fires in sprinklered properties occurring during 1948.

The largest was the $1,000,000 loss sustained on March 2nd by the destruction of the Charles Moore and Company Department store at Adelaide, South Australia. This three-story building, built in 1916, had a ground floor area of about one acre and was completely protected by automatic sprinklers *except* for a concealed space between the top floor and the roof which was about 3 ft. high at its highest point and went down to nothing. In this area there were 30,000 sq. ft. of flooring timbers and a "forest" of wood roof supports. The fire presumably was caused by an electrical short and the first warning of any trouble was the operation of 12 to 20 sprinklers on the floor below, which registered an alarm at the Adelaide Fire Brigade headquarters. Firemen arrived promptly and proceeded to enter the building to attack the fire, when a 20 ft. by 30 ft. portion of the roof and ceiling fell in, breaking sprinkler piping in the area. It is evident that the fire must have smouldered in the low concealed space for a considerable time. Once the roof fell in, the fire gained headway quickly through the large opening in the center of the building in which there was a marble staircase. Strong winds contributed to fire spread and combustible stocks common to such occupancies provided additional fuel for the flames. With some sprinkler piping ruptured and heads throughout the structure opening simultaneously, control could not be established. Fire in a low *unsprinklered,* concealed space doomed the entire establishment.

At Waterville, Quebec, a somewhat similar loss occurred on March 19th, although the concealed space in this instance was between the first floor ceiling and the second floor and the property involved was a textile mill. The existence

of this floor cavity (2 in. to 7 in. in height) was the result of a previous fire in 1945, after which a new floor was laid over 2-in. planking and 1-in. flooring which had been partially burned and badly warped. In the current fire (which originated about 9:10 P.M. in a light wood yarn box near a paperboard wall partition), sprinklers on the first floor operated and the fire was thought to be under control by 10:00. It was not realized, at that time, that the fire had progressed up the partition and into the unprotected concealed space, and flames broke out on the second floor about 15 minutes later. With this second outbreak, the fire spread quickly, feeding on textile yarns and fluff. Whether or not sprinklers were on during this entire period is not definitely established, but the 50,000-gallon gravity tank was emptied and the 750 gpm fire pump, providing secondary supplies to the sprinklers, had been placed in operation by the plant engineer. Fire Department operations in the early stages were severely limited, as it was necessary to take suction from a river 700 ft. from the plant and only enough hose for one line was available. Requests for mutual aid assistance from North Hatley and Sherbrooke were unnecessarily delayed. The watchman (an invalid) was asphyxiated by smoke and, although rescued, could not be revived. Again, a concealed space lacking sprinkler protection doomed the entire mill. The loss is estimated at $400,000.

The Beach Furniture Company fire on April Fool's Day possessed ironic implications. The fire originated in a spray booth on the third floor and was believed caused by ignition of lacquer residues from an electric motor spark. An employee attempted to reach the flames with a foam extinguisher, but smoke and fumes developed so rapidly that he was unable to reach the base of the flames. The spray booth itself was an all metal unit type which did not extend to the ceiling, and while *no sprinklers* were installed therein, sprinklers over the booth and in the immediate vicinity (a total of 83 heads) operated. Paints and oils stored in the immediate vicinity plus residue coatings on the floor and walls produced a hot fire of essentially a class "B" (flammable liquid) type and flames penetrated to the ceiling between operating sprinklers. Because the ceiling was constructed of highly combustible ¼-in. fibre board, the fire passed through into the joist channels between the ceiling and roof, with the consequence that approximately 4,500 sq. ft. of this concealed space was destroyed. Once out of the range of sprinkler protection the only means to achieve control was to boost the pressure on hose lines sufficiently to peel the fibreboard off the joists and to attack the flames directly with these streams. The fire burned for 1½ hours before it was extinguished. The irony of the facts should serve to illustrate that unprotected concealed spaces are vulnerable spots which will weaken any protective means devised to reduce fire losses, particularly where highly combustible wall board is used to blank off such areas.

Fire in another type of concealed space — an escalator enclosure — provides a different illustration for our analysis. A night watchman discovered a fire under two adjoining escalator units in the May Department Store in Los Angeles at 1:45 A.M. on April 10, 1948. The fire was feeding on refuse which had found its way into the space and had communicated to a wooden balustrade which separated the two units and to wooden stair treads on the old style escalators (installed in

1923 and 1929). Six sprinklers on the first floor and several on the second opened about the time of discovery, but naturally could not reach the base of the fire. The public fire department was called and had to chop away portions of the balustrade to quench the sheltered fire with hose streams. The amount of loss was increased by the fact that the type of escalators involved were obsolete and will have to be completely replaced.

Fire, starting probably from a short circuit in a fluorescent lighting fixture ballast ignited combustible paper covering of insulating batts in contact with the fixture above the acoustic ceiling on the fifth floor of the United States Envelope plant in Springfield, Mass., on February 21. While sprinklers were installed under the roof and 77 operated, the fire was shielded by the insulation blanket and air conditioning ducts and final extinguishment in the concealed area was not accomplished until firemen could reach the area with small hose streams. Full details of this fire appeared in the July 1948 QUARTERLY, pages 24-27.

Constructive suggestions to eliminate repetition of such fires apply equally to the automatic sprinkler industry, insurance interests and property owners:

(1) Install sprinklers in all shielded areas and concealed spaces where a fire might develop out of sight of human detection and out of range of sprinklers supplied to the balance of the structure.

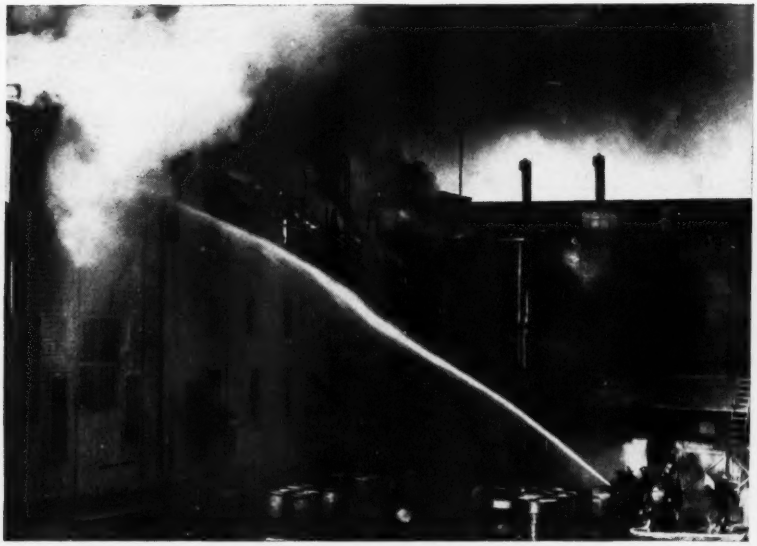
(2) In climates where freezing is possible, such sprinkler installations should be dry pipe equipment.

(3) Watch particularly for alterations, the installation of "hanging" ceilings and the blanking off of wall spaces creating hollow chambers which will permit fire to develop lethal intensities before discovery.

Insufficient Water

Proper hydraulic engineering for automatic sprinkler equipment is truly essential in the maintenance of a 95.9% or higher record of satisfactory performance. There are too many factors involved to discuss the technical aspects of water supplies in this article, but it is particularly germane to this study to emphasize that already installed equipment — as well as new installations — requires evaluations of hydraulic requirements periodically. Let us look at four fires that have occurred in 1948 so that we may better understand the problems involved.

The $200,000 fire loss at the sprinklered flour mill of the Valley City Milling Company plant in Portland, Michigan, on January 16th, provides a significant lesson. This property consisted of a wooden flour mill with attached wooden grain elevator and wood warehouses. The ground area of combustible construction totaled about 7,500 sq. ft. and the height of the mill and elevator sections was about 65 ft., with a small cupola 36 ft. high on the roof of the elevator. This group and a communicating brick power house were protected by a dry pipe sprinkler system installed in 1926. The entire system was controlled by a single six-inch dry pipe valve equipped with a quick-opening device. The real difficulty was that the sole source of water supply for the sprinklers was from the village water system through a six-inch line from a circulating six-inch main. This supply depended on an 85,000-gallon elevated standpipe normally supplied by electric pumps from two separate wells. A few days before the fire, one of the wells developed a "sand leak" and this became so bad that the pump had to be shut down, with the result that on Thursday, January 15th, the water supply in the standpipe



Acme

This Cleveland lacquer factory, which burned on March 5, was of wood construction and protected by an "ordinary hazard" dry pipe sprinkler system installed in 1914. Despite the class of occupancy, the protective equipment was not redesigned and modernized to conform to present-day standards for such an "extra hazard" plant. The sprinklers were accordingly overtaxed and the loss estimated at $250,000.

became seriously low. During that day (temperature dropping to zero), much of the remaining water was used to make a skating rink. Friday morning at 6:00 o'clock fire was discovered in the mill by an employee. The alarm was called in to the telephone exchange but, because the fire siren failed to respond to its remote control switch, firemen were called individually and the first piece of apparatus did not reach the scene until 6:30. Sprinklers were operating, and when additional fire equipment arrived, orders were given that they be set up to take suction from outside hydrants and pump into the mill sprinkler system. For some reason this was not done and precious water was wasted through ineffective hose streams until the supply failed to such an extent that pumpers drew a vacuum. In the meantime, fire gained great headway in the highly combustible contents, and the property was eventually burned to the ground, the town left without an important industry and its employees thrown out of work. Perhaps it was foolish to depend solely on the uncertain public water supply — certainly it gave the insurance underwriters and the property owner a false sense of security and, in the end, cost them both heavily.

At Huntington, Indiana, the Majestic Company plant was in full operation on Friday, January 23rd, at 8:57 A.M. At 8:58 things started to go wrong when a spark from an electric welder ignited naphtha thinned paint in a 200-gallon dip tank. Employees used hand extinguishers,

Rickert Studio

This fire in the large area Majestic Co. in Huntington, Ind., on Jan. 23, 1948, shows that sprinklers cannot be expected to do effective work without adequate water supplies.

but flames spread quickly over the floor where sawdust had been used to absorb the paint from a previous dip tank overflow. Unfortunately, a sprinkler supply line for ten sprinklers located in the dip room and adjacent conveyor enclosure had frozen the day before this fire and while fittings that had burst had been replaced and the system restored to service, ice in the piping was not entirely removed. This ice prevented sprinklers in the immediate area from operating, and when two sprinklers in the top of the conveyor (supplied from another source) operated, the water discharged caused the dip tank to overflow. Flames then traveled through an unprotected conveyor opening into a communicating building, opening many sprinklers. The fire department responded to the alarm and placed three 750 gpm pumpers in service for six hose lines using public hydrants. Unfortunately no attempt was made to reinforce the sprinklers through available fire department connections. The heavy water demand of both sprinklers and fire department operations reduced pressures so seriously that any semblance of effective sprinkler work was negated. Again, the reliance placed on a single main resulted in unsatisfactory sprinkler performance. The sprinkler company whose equipment was involved has commented: "Recommendations for a secondary supply were prepared constantly, but somehow the pressure was never applied to enforce the suggestion, even though it was greatly needed."

A 48,000 sq. ft. wooden building on the property of the J. F. Weaver Lumber Company just outside the city limits of Jackson, Miss., was destroyed by fire on the night of January 4th. While the incipient fire was under sprinkler control when discovered by the watchman, a delay in sending in the alarm and a further delay before city equipment could reach the out-of-town plant gave the fire plenty of opportunity to match its powers against the operating protection equipment. When flames reached empty paint drums, explosions occurred which sent some flying 100 feet above the building and these spectacular events provided loud evidence that sprinklers were losing the battle. So many heads opened that water from an eight-inch dead-end main capable of sup-

plying 480 gpm at 15 psi proved entirely inadequate. The secondary supply (100,000-gallon tank on a 100-foot tower) should have reinforced the weak primary source, but with all sprinklers operating even this quantity did not meet the demand.

A fire on 58th Street in New York City on January 2nd provided another type of loss in a sprinklered building which was unnecessarily large due to inadequate water supplies. Originating in a non-sprinklered five-story structure, fire spread into a twelve-story sprinklered building, opening so many sprinklers on various floors that the gravity tank water supply was soon exhausted. The amount of water required to supply these sprinklers was much in excess of what the Fire Department could supply through the street siamese connection, with the result that water pumped into the system did not reach the eleventh and twelfth floors. The persistent heat of the exposure fire thus ignited or reignited the contents on the twelfth floor of the sprinklered building which burned furiously and was finally extinguished only by hose lines.

These fires give pertinence to the following suggestions:

(1) That the insurance and the automatic sprinkler industry engineers should inspect installations in service frequently and should pay particular attention in new jobs to the hydraulic engineering requirements of the protection.

(2) That automatic sprinkler contractors making original installations, alterations, or additions should evaluate water sufficiency and should be alert to local conditions which might alter the adequacy of the supply, particularly from public sources.

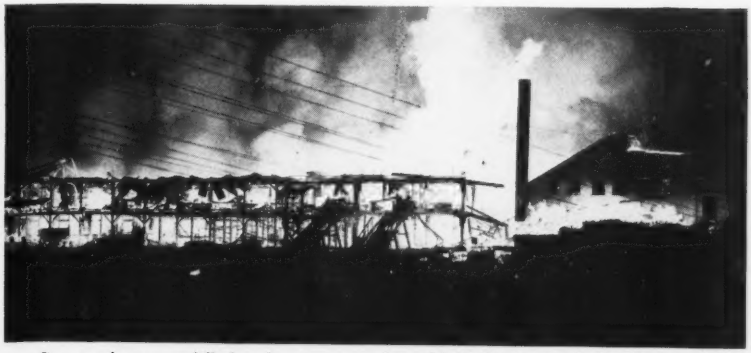
(3) That insurance interests should not be guided so much by the minimums recommended in the Standards as by the potential water supply demands of the individual property being protected.

(4) That property owners and occupants should be taught that sprinkler efficiency may be measured by water sufficiency and that any compromises of the latter to save dollars will render their properties vulnerable to serious loss.

Hazard of Occupancy Too Severe

All the nine fires in sprinklered properties, where occupancy hazards were responsible for overpowering the protection equipment, involved manufacturing occupancies, four of these in woodworking plants. It should be particularly noted that in the majority of these cases the occupancy hazards, responsible for the heavy losses, were imposed *after* the original sprinkler installation.

On January 23rd at Peru, Indiana, the splint basket factory of W. C. Redmon Sons & Co. sustained a total loss when fire broke out about 4:15 A.M. in the spray finishing section on the second floor of their ordinary brick wood-joisted plant of approximately 25,100 sq. ft. ground floor area. Discovered by a watchman (who failed to give the location of the plant when reporting the fire by telephone), flames were breaking through the windows as the first piece of fire equipment reached the scene. It was thus clear that operating sprinklers were quickly overcome and the chief factors responsible were: (1) heavy deposits of paint residues in the spray booths and on the floor, (2) acetone and acetone-soaked pyroxylin plastic stored nearby and (3) quantities of highly combustible stocks in the area. To combat a fire in such materials, the dry pipe sprinkler system in the immediate area was simply insufficient, for it had not been originally designed for this extra



One employee was killed and an insurance loss of $500,000 incurred when fire struck this sprinklered plant of Price Brothers & Company in Priceville, Quebec, on June 2nd. The sprinkler equipment provided was a dry pipe system with about 1,200 heads and a single source water supply (8-inch connection to the town main). Heavy accumulations of sawdust throughout the woodworking plant, unprotected vertical openings, and moving machinery belts were responsible for the rapid spread of fire, which overtaxed the "ordinary hazard" sprinklers in the "extra hazard" plant.

hazardous occupancy and had not been modernized. Inadequate water supplies, an unreliable quick opening device at the dry valve, an excessive number of heads on one system, and failure of the fire department to utilize the sprinkler connection contributed to the extensive spread of fire throughout the large area plant. The loss is estimated at $195,000.

The fire at the Price Brothers & Co., Ltd., plant in Priceville, Quebec, on June 2nd resulted in one death and a property loss of $500,000. Flames broke out at 8:20 P.M. when about 120 men were working in the sawmill, most of them on the second floor. It seemed to the latter employees that the fire came through the floor at various points (stairs, belt holes, etc., unprotected) and was propagated with explosion-like rapidity. In less than two minutes, both floors of the 22,000 sq. ft. lightly constructed wood building were involved. The rapid spread of fire forced the occupants to run for the exits and one 64-year-old man failed to reach safety. The sprinkler equipment provided was a dry system with about 1,200 heads in the mill and a single source water supply (8-in. connection to town main). All valves operated and heads opened, but even if the water supply available had been more adequate, the sawdust conditions and moving belts would undoubtedly have carried the flames through the mill and resulted in overpowering the protection. It must be remembered that even a small fire will set up draft conditions which, in large area sawmills with many unprotected vertical openings, are capable of dislodging dust deposits on the beams and other framework. This usually will provide almost explosive dust atmospheres. Obviously, the corrective measures needed to prevent recurrence of such contingencies rest jointly with plant management — for housekeeping — insurance and sprinkler engineers — extra hazard systems with special protective equipment for vertical openings.

The Southwest Lumber Mills fire of June 15, 1948, at McNary, Arizona, was a particularly severe loss in a sprinklered plant. The fire started in an electric motor (apparently caused from an excessive ac-

Acme

This fire at the Chicago Curled Hair Company plant on February 8th, raged beyond sprinkler control because of the severe occupancy fire hazards of dust and lint, unprotected conveyor and duct openings in the floors, poor sprinkler maintenance by the Company's employees and the absence of any experienced supervision over the part wet and part dry pipe equipment installed in the rambling property.

cumulation of dry sawdust) at a large matcher. Employees used compressed air to blow the fire out of the interior of the motor, and some of the burning oil-soaked sawdust ignited wood refuse in a concrete pit foundation under the machine. Employees extinguished this fire, but, in the meantime, an exhauster (used to accumulate refuse produced by the machine) had picked up some of the burning sawdust and started it on its way through an extensive dust collecting system towards the fuel house. Before it reached the fuel house, the large fan operating the collector was shut off and this left many small particles of burning refuse deposited throughout the piping system. The hot fire gases created an internal pressure in the piping, resulting in a mild explosion which split the pipe seams, causing fires to break out at many points, and sprinklers accordingly fused over a large area. Although water supplies were adequate for an ordinary sprinklered property (50,000-gal. elevated tank; two 1,500 gpm. centrifugal pumps taking suction from a log pond of almost unlimited capacity), the large area frame building (over 100,000 sq. ft), the highly combustible contents, and the simultaneous outbreaks throughout the building overtaxed the system. Fire pumps operated steadily for four hours, sprinklers continued to operate and fire fighters used in excess of 4,000 gallons of water per minute in fruitless efforts to halt the fire. The loss is estimated at $1,400,000.

The Kentucky Inspection Bureau's report on the Paducah Box and Basket Company fire of August 14 states that "the sprinkler equipment in this plant was at a

great disadvantage because of the light construction of the building, the high combustibility of the stock, somewhat high ceilings, the fact that stock was piled too high and without aisleway separation, and the fact that fire in some of the buildings may have originated on the outside and gained headway before reaching sprinkler protection. In view of this and other fires which have occurred at this plant, there seems reason to question the adequacy of dry pipe sprinkler equipment installed under *ordinary* hazard rules with *ordinary* water supplies, in controlling fires of the type that may be expected in occupancies of this sort." This fire may have been of incendiary origin, since two warehouses 75 ft. apart were equally involved when fire equipment first reached the scene, but this cannot be determined accurately since the 10:08 P.M. alarm was delayed, the plant was not in operation when the fire occurred, and no watch service was provided. It is viewed possible that flying brands might have been responsible for the spread and only effective fire fighting saved other seriously exposed buildings, including the largest on the property (150 ft. x 175 ft.) from similar ignition.

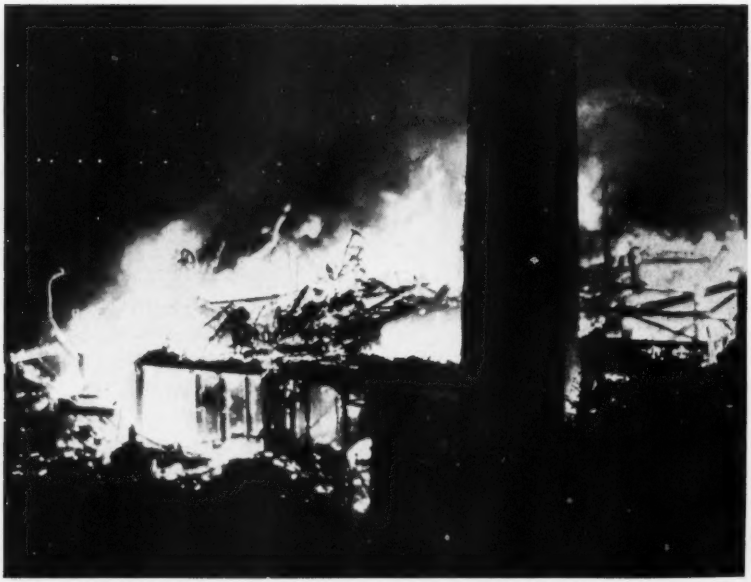
Other occupancies, besides woodworking plants, have serious inherent dust hazards which demand special protective equipment. The large fire loss at the Chicago Curled Hair Company plant on February 8th is an example. This property was a two and four-story ordinary brick and wood-joisted structure equipped with a combination of wet and dry pipe sprinkler systems. Evidence indicates that the sprinklers were not well maintained, were altered frequently by unskilled owner employees and that housekeeping conditions were not favorable. The fire was not detected until it had progressed downwards from the second floor and was noted by employees working on the first. Upon arrival, the Chicago Fire Department placed pumpers at two siamese sprinkler connections and thereby continued ample water supplies to the operating heads. Six additional alarms for manual fire equipment were required as the fire raged out of sprinkler control. The principal reasons for the unsatisfactory performance were that the fire flashed throughout the property feeding on large quantities of dust and lint and that numerous conveyor and duct openings between the floors resulted in passing heat and flames throughout the structure without restraint. Under such conditions, the poorly maintained sprinkler system was overcome.

Even paper plants possess dust hazards which, in combination with other factors, might be responsible for unsatisfactory sprinkler performance. The Phœnix Toilet Paper Company plant at West Phœnix, N. Y., was totally destroyed by fire on July 14. This property was an inferior, two-story, wood-joist paper mill occupied for the manufacture of tissues from ground wood and sulphite pulp. It was protected by a 1905 standard dry pipe system with a weak primary water supply from a 6-in. village main and a good secondary water source from a 50,000-gal. gravity tank. The sprinkler protection was, however, severely handicapped by the fact that the dry pipe valve was an unapproved, obsolete model, lacking a quick opening device and, further, that it was overloaded. When the fire occurred (1:15 A.M.) it was promptly discovered by an employee, who telephoned the alarm. Sprinklers operated and held the fire in check during the first few minutes, but as the heat radiation built up, the fire flashed over the machine room, feeding on paper, lint and dust on

the floor, beams and walls. Several fire departments from nearby communities fought the flames until noon the next day.

Flammable liquid vapors, of course, present another potential hazard of occupancy which, under certain conditions, might be responsible for producing fires capable of overpowering sprinkler equipment not designed specifically for the hazard.

The Elliott Electric Co. fire in Cleveland on January 14 is an example of a fire which spread quickly following ignition of volatile liquids in two 15-gallon dip tanks which were not provided with any automatic protection equipment (in the form of special extinguishing systems, automatic covers or drains). No one was in the plant when the alarm was received via a water-flow signaling system on a central annunciator in a neighboring plant. Following investigation of the cause of the alarm (resulting in some delay), a signal was sent into ADT headquarters at 6:24 P.M., which immediately relayed the call to the Cleveland Fire Department. Firemen arrived to find flames well advanced and were forced to use sixteen 2½-in. hose lines plus deluge nozzles to knock the fire down and protect adjoining buildings. Chief James E. Granger of Cleveland advised the NFPA that his Department had "definitely concluded that the automatic sprinkler system was in operation with no valves turned off at the



Wide World Photos

A 1905 standard dry pipe sprinkler system with a weak primary water supply from a 6-inch village main and a good secondary water source from a 50,000-gallon gravity tank was not sufficient to cope with this fire in West Phoenix, N. Y., on July 14. Lack of a quick opening device, too many sprinklers on a single valve and excessive hazard conditions in heavy accumulations of paper dust (incident to the manufacture of toilet tissues) prevented the sprinklers from maintaining fire control.

time of the fire" and that the system was not shut off until "after the building was gutted and the fire under complete control." Since the water supply to the wet pipe sprinkler system was deemed adequate and maintenance was satisfactory, it can only be concluded that the hazard of occupancy was too severe for the standard protection provided on the floor of origin.

Two other 1948 fires involving sprinklered properties where flammable liquid occupancy hazards proved too severe for standard protection were reviewed in the April (page 289) and July (page 55) issues of the QUARTERLY. These fires involved the Glidden Company pine products plant at Jacksonville, Florida (February 6, 1948) and the lacquer factory of the Arco Company in Cleveland (March 5, 1948).

The lessons we should learn from these fires are:

(1) That the insurance engineers should require and the automatic sprinkler industry should provide equipment to meet the potential hazards of occupancy in each installation.
(2) That automatic sprinkler contractors must evaluate the occupancy hazard conditions each time they alter or extend an installed system.
(3) That insurance interests should not accept standard installations where extra hazard equipment is indicated.
(4) That property owners should consider the effects of introducing special hazards into their plant and should call on their fire protection advisers for their engineering knowledge before making such changes.

Partial Protection

Providing sprinklers for part of a structure or group of structures is recognized practice in certain types of properties. In fire-resistive hotels, for instance, areas possessing special hazards are often sprinklered, but they are also cut off by substantial fire-resistive walls with openings protected by approved fire doors. Partial protection in the usual industrial, mercantile, storage or habitational structure, however, often produces unsatisfactory results.

The Federal Grain Company plant in Winnipeg consists of a concentrated group of wood, wood-metal-clad, and fire-resistive buildings. The 60,000 bushel elevator is sprinkler protected as are two fire-resistive grain warehouses which flank this central building. Immediately adjacent to these buildings, however, a 50,000 bushel capacity grain storage shed of wood, metal-clad construction (25 ft. by 175 ft. and 26 ft. high) was *not* sprinklered. At 8:50 P.M. on April 21, fire was discovered by an employee in this latter building and, urged by an 11 mph wind, flames quickly communicated to the elevator, entering under the eaves of the cupola which was 78 ft. high. The Winnipeg Fire Department responded to a telephone alarm and immediately connected two 2½-in. hose lines to the elevator sprinkler system. Twenty sprinklers in the cupola operated and held the fire in check, with complete extinguishment accomplished by the use of one hose line. The warehouse in which the fire started was a total loss, 22,000 bushels of wheat and oats damaged, and the lesson, as expressed by the Western Canada Insurance Underwriters' Association, is "that unsprinklered buildings or sections should be cut-off either by fire walls or a clear space from sprinklered buildings."

At the Western Forest Industries plant, Honeymoon Bay, British Columbia, a fire which originated in an unsprinklered sawmill at 8:00 P.M. on July 3, was driven by wind to involve one other unprotected building and the sprinklered wood mill,

lath mill, fuel bins and part of the power house. The loss of protected buildings was about 25% of the fire area involved and all these structures were of combustible construction. Efforts of the volunteer fire department to boost pressure in underground mains were unsuccessful because of the large number of sprinklers operating, probable rupture of standpipe mains, and the inaccessibility of control valves in the burning area. Property losses are estimated from $450,000 to $600,000 and the use and occupancy losses about $465,000.

The above cases are cited to show one type of problem introduced by partial protection — a group of structures comprising a single plant, with fire originating in an unsprinklered section. At a fire in Anderson, Indiana, on May 26, a multiple occupancy mercantile-apartment building illustrates another phase of the problem introduced by partial protection. Here fire originated on the first floor in a rubber vulcanizing room under rather indifferent sprinkler protection. When the fire was first detected by a passer-by at 8:40 P.M. flames had progressed through the roof of the three-story building via unenclosed stair shafts and into unsprinklered areas. Twelve hose streams were required to halt the blaze, and this was not successful until all floors had collapsed. In 1940, this property was inspected by insurance engineers, who found that "the sprinkler equipment is a non-standard installation covering only a section of the risk and considered of little protective value." Eight years later their judgments were put to test and found painfully correct.

Still another type of loss liable to be incurred and falling into the "partial protection" category is illustrated by the Rex Grain and Milling Company fire at Buffalo on August 13. Here, in a plant protected by two dry pipe systems of 1916 vintage, the owners removed quite a few sprinklers and pipe to make way for some new milling equipment. Fire, ironically, originated in this unguarded area about 1:20 A.M. and gained considerable headway before being checked by properly operating sprinklers in the balance of the structure.

The obvious wisdom taught by these fires, applicable alike to the sprinkler industry, insurance engineers, and property owners, is that partial protection is exactly what its name implies. While properly installed and maintained sprinklers might succeed in checking flame spread (as at the Winnipeg and Buffalo fires), the least deficiency in building construction, the introduction of any measurable contents hazard, or any extended delay in detection, alarm transmission, or fire department response, will undoubtedly so compromise the protection afforded as to render it ineffective (as at the Honeymoon Bay and Anderson fires).

Explosions Wrecking Systems

Explosions followed or preceded fires on February 12th at the Canadian Film Laboratories at Etibocoke, Ont., on March 6th at the Interlake Chemical Corporation plant at Waltham, Mass., on March 15th at the International Harvester Company's engine test plant at Louisville, Ky., and on September 7th at the E. J. Brach & Sons Candy plant in Chicago. All these properties were protected by automatic sprinklers and in each case the damage to the systems rendered them inoperative or ineffective.

At the film laboratory, fire gained headway quickly as nitrocellulose film in quantities greatly exceeding standards of the industry was exposed to ignition within sec-

Acme

While the water supply and maintenance of the sprinkler protection in this plant in Cleveland was "adequate," flammable liquid dip tanks (lacking any special protection) permitted a fire originating in the coil dipping department to spread beyond sprinkler control on January 14.

Acme

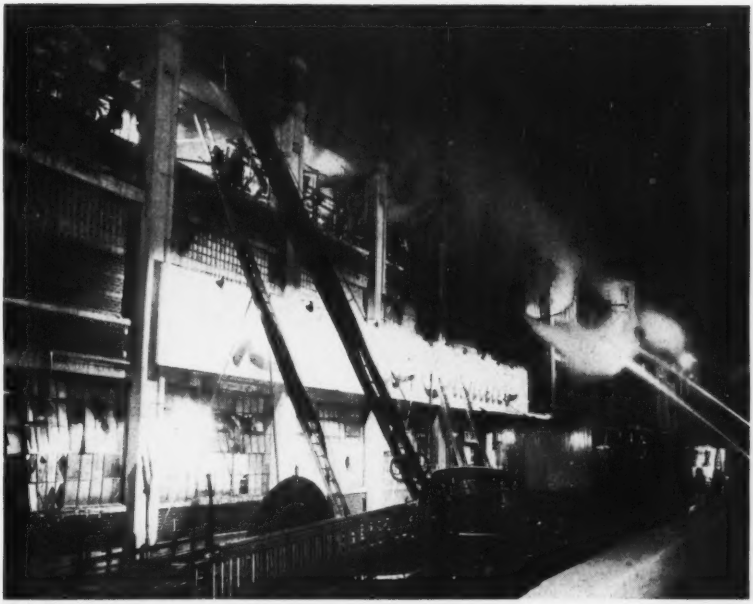
Five workmen were killed and 29 injured when wood flour dust, used as a filler, exploded and wrecked this Waltham, Mass., plant on March 6. Plastics moulding compounds were being manufactured and a fire in the same building in January spread over dust that had accumulated on the beams. The sprinkler equipment was not a factor in fire control, except in an office section, as the explosive venting was not adequate and the sprinkler system was literally "blown to pieces."

onds of the initial outbreak. Employees just had time to escape from the area when the gases of decomposition were ignited and produced internal pressures exceeding the strength of the superior building construction. Sprinklers operated but hardly had an opportunity to be effective before the blast occurred.

The Waltham explosion, which killed five employees and injured 30 others, was reported in detail in the April, 1948, QUARTERLY (page 295). Sprinkler protection was not a factor in fire control (except in the office section) as the explosion so completely wrecked the main plant that the equipment was "blown to pieces."

Accidental ignition of gasoline vapor and air in an unventilated basement tank and pump room caused the explosion at the Motor Test Building of International Harvester's Farm Tractor Division. The blast killed eight persons, caused extensive damage to one entire end of the building, broke branch sprinkler piping in many places and also ruptured one of the main water supply lines for the installed fire protection equipment. The fire which followed opened many sprinklers but their effectiveness was impaired by broken piping.

The tragic fire and explosion at the Brach Candy Company killed 17 persons. A fire in a candy mold dryer resulted in a series of cornstarch dust explosions. The sprinkler equipment became inoperative as a result of the blasts. Insufficient



Wide World Photo

A smoldering fire in a drier used in a candy molding operation at the large Brach Candy Company plant was the ignition source for a series of explosions in cornstarch dust which killed 17 employees and caused extensive damage to sprinkler equipment on September 7 in Chicago. The loss, including business interruption, from the fire and subsequent explosions is estimated at about $5,000,000.

details are available as this article is written to give positive information as to whether sprinklers operated prior to the explosion.

Control over explosion hazards is clearly outside the sprinkler engineer's field, but the existence of such potentials should be carefully checked and explosion venting urged upon the property owner. Specialized sprinkler equipment (deluge, water spray, etc.) might afford increased opportunity for fire control during the precious seconds following ignition and prior to detonation and should be provided wherever possible.

Improper Maintenance

Two cases of clogged piping, one case of serious pipe corrosion, and one instance where a valve was set too tight for proper operation provide good illustrations of improper maintenance of sprinkler equipment and of consequential ineffective sprinkler performance.

On February 25th, an acetylene cutting torch ignited the usual accumulation of grease and lint on an old air duct being dismantled in the Cumberland Undergarment Co. plant in Cumberland, Md. Flames flashed through the duct and through outlets on each of the two floors of the 250 ft. by 85 ft. brick, mill type sewing factory. Employees delayed sending in an alarm to the fire department while making attempts to extinguish the fires. Sprinklers nearest the duct were so clogged with dirt that what water was discharged could not reach the fire in the

duct and the heat spread over a large area, opening 25 heads. Directly over some of these ineffectively operating sprinklers, the ceiling was charred to a depth of ¼ to ½ in. Inspection showed that cross mains contained small quantities of stones, shale, splinters, cinders, etc., such as might enter mains during repairs. End lines on the top floor and in the basement were heavily obstructed by soft silt. Final control was only secured by fire department hose streams.

Tests made following the fire at the Collins Manufacturing Co.'s paper plant in North Wilbraham, Mass., showed internal obstruction to approximately 17 heads, three of which were directly over the original fire, which broke out at 1:36 P.M. on April 18. It started when a partially filled drum of sodium peroxide fell to the floor while being moved on a hand truck. Apparently, moisture had been absorbed by the peroxide (drum cover not tight) while in storage and hydrogen peroxide was formed, which decomposed with the force of the jar. Seventy-eight sprinklers operated, but five 2½-inch hose lines and chemicals were required to stop the flames. The "all out" was not sounded for three hours.

Pipe corrosion, especially where concealed from casual view, is difficult for the layman to detect and is a good reason for expert inspection services. At the Shukert Building fire in Kansas City, Mo., on June 11th a corrosion-weakened fire department connection in the basement gave way when water was pumped into the sprinkler system to aid in the extinguishment of a fire on the top floor of the five-story building. This blaze was actually confined to the immediate vicinity of the elevator penthouse and had worked into an unprotected concealed space only 3 ft. deep at the highest side. Firemen, including the Chief, were on the roof extinguishing flames in this area when the basement pipe gave way under the pressure from a pumper and considerable time elapsed before the Chief could be reached to give orders to stop the pumps. Water damage in the basement was thus severe (damage estimated at $11,000), while the fire loss in the penthouse is estimated at only $3,000.

At the Creech Upholstery Manufacturing Co. plant in High Point, North Carolina, on February 5th, a dry pipe sprinkler system failed to function when fire struck in the three-story structure of combustible construction. Detected by an employee on the top floor at 7:28 A.M., attempts were first made to use a hand extinguisher, but access to the fire area was denied by flame spread. A telephone alarm resulted in the arrival of four pumpers, and ten hose streams were placed in operation in efforts to halt the fire. The entire building, 60 ft. by 220 ft., lacking vertical or horizontal fire stops, was eventually totally destroyed. Investigation disclosed that no water passed the dry valve and it was established that a local contractor had filed the adjusting screw and had tightened it so much that the valve was jammed and could not trip. The valve involved was badly worn with age and should have been replaced rather than repaired by persons not familiar with its construction and operation.

Improper maintenance can thus be shown to have a marked influence on the sprinkler record and brings us the following recommendations:

(1) That the automatic sprinkler industry should establish their own maintenance and service inspections of installed equipment to assure continuity of protection and proper upkeep.

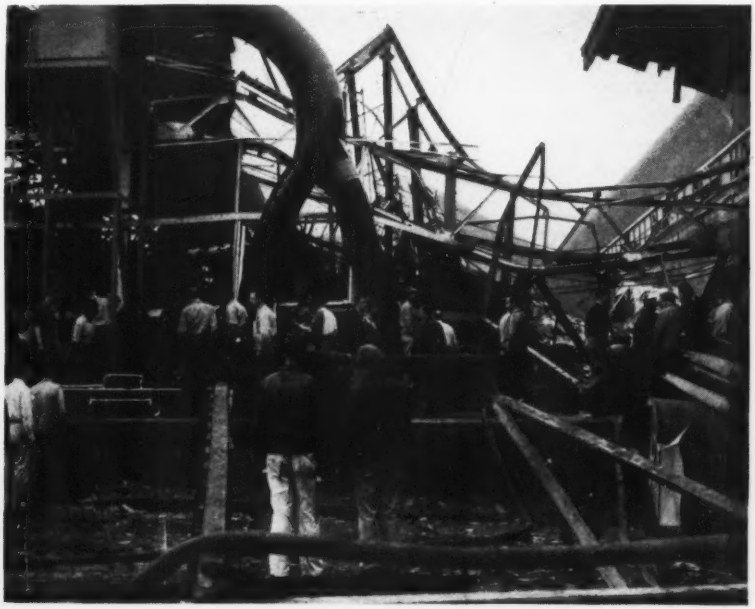
(2) That automatic sprinkler contractors should constantly emphasize the importance of inspection and maintenance of such systems as installed by them and should not undertake the repair of devices of other manufacturers about which their knowledge is limited.

(3) That insurance interests should encourage service and maintenance contracts between the automatic sprinkler contractor and the assured. Their own sprinkler inspections should not duplicate such services but, if desired, should be coordinated.

(4) That property owners should realize that sprinkler equipment, like any mechanical device, has an age limit of effective service. The country is loaded with obsolete systems, the maintenance of which is of dubious quality even at best and the renovation of which is dictated by age and improvements in design.

Premature Shut Off

There seems to be a deep seated impulse on the part of plant employees and property owners to shut off sprinkler equipment before final fire control is secured. In the main, this impulse is motivated by a desire to reduce "water damage" and is rarely malicious in intent. The big trouble is that the fire is not always as well mastered as is assumed by these untrained people and the net result is often disastrous. They also often do not realize that hose streams usually produce much greater water damages than is occasioned by the discharge of a few sprinkler heads directly over the fire area.



Courier Journal and Louisville Times

Sprinkler branch piping was broken in many places when accidental ignition of gasoline vapor in an unventilated basement area of the Motor Test Building pictured above caused a severe explosion. The fire which followed opened many sprinklers, but their effectiveness was impaired by the broken piping.

A case in point is the fire at the L. A. Young Spring and Wire Corp. plant in Detroit on February 13th. During a gas shortage in the city, the decision was made to speed up the drying and baking cycle following the dipping of springs in an 8,400-gallon capacity dip tank. Overlooked was the hazard of vapor accumulation in a 120 ft. gas-fired drying oven, and about 11:14 A.M. ignition occurred and flames quickly flashed back to the dip tank. Special protective equipment at the oven (carbon dioxide) and at the dip tank (foam and an automatic dump valve) failed to perform properly and the only defense left was automatic sprinklers installed throughout the property. Fearing that these sprinklers would overflow the dip tank, the system was shut off by employees and despite spread to three floors neither they nor the fire department restored the sprinkler protection. Hose streams, meanwhile, caused the feared dip tank overflow and damage to the building was considerable (including collapse of a section of the roof, warping of structural steel roof and floor supports, and bulging of masonry side walls). Equipment in the building was nearly all destroyed and damage to stock was very heavy. The loss is estimated at $500,000 and much of this may be directly charged against the premature closing of the sprinkler water supply valve.

Another incident occurred at the cotton yarn manufacturing plant of the Crywood Corp. and Textile Thread Co. in Fall River, Mass., on March 29th. Here a "flash" fire occurred in loose "fly" and flames communicated to baled cotton. Employees apparently attempted to control the fire with hand extinguishers, aided by sprinklers, before turning in an alarm. Thinking they had the situation under control, they turned off the sprinklers to save water damage to vulnerable stocks. When the fire department arrived, the flames had such a grip on the stored cotton that the officer in charge ordered sprinklers restored. With their help (10 heads) and two hose lines the fire was extinguished, but with considerable more water damage than would have occurred if the sprinklers had been left operating and the alarm not delayed. Approximately 113 bales of cotton (77 Egyptian) were fire damaged and 54 more bales water damaged. Motors, carders, pickers, and drawing frames also sustained water injury.

The lesson to be learned from such fires is obviously that educational efforts are required to curtail the occurrence of such instances and all parties concerned should put their shoulders to this task with a vigor commensurate to the dire need. Perhaps the first step for property owners is to centralize responsibility for fire protection in the hands of one individual and to organize plant fire brigades which will be trained in the basic elements of all the protective equipment available in the property.

Frozen Systems

Failure to guard against freezing is a special winter maintenance problem which deserves the separate attention given in this analysis.

Take, for instance, the fire of January 20th in a wood-iron clad warehouse on the property of the Pennsylvania Bottle Company in Sheffield, Pa. This building was completely protected by a dry pipe sprinkler system backed up by city water supplies and a 100,000-gallon water tank. All the water in Warren County, however, wouldn't have helped in this emergency. The system was completely frozen, includ-

ing the supply lines to the two dry pipe valves housed in the warehouse. Outside temperatures at the time ranged from –15° to –20°F. An examination of the sprinklers which operated proved conclusively that no air or water went through the system, as the copper gasket beneath the cap of each sprinkler was in place on the orifice. The loss was total to the warehouse of origin ($27,000) and to its contents of ($50,000).

In the Hotel Delaware fire at Ocean City, New Jersey on February 13th, water never got farther in the system than the piping in the dry valve enclosure which had burst because of freezing. The closed hotel (seasonal operations only) was provided with 1,306 automatic sprinklers divided about evenly on three dry pipe systems, supplied from a six-inch connection from the city water main. The fire was discovered, entirely by accident, by the Manager of the Ocean City Water Service Company, who was searching for possible leaks in the underground system after noting unusual local consumption following a break in the freezing temperatures. After the fire department arrived and the building entered, 14 inches of water was found in the basement and not a drop for about 600 fused sprinklers, as flames spread from the ground floor up a stairwell and elevator shaft and mushroomed all over the third floor and attic. It is considered probable that the water in the basement entered "BX" cables, causing a short circuit and starting the fire. Other parts of the sprinkler system on the city side of the dry valve were found ice blocked as long as four days afterwards, during which period there was no frost in the vicinity. The loss for this frozen piece of pipe is estimated at $150,000.

Obstructed Distribution

On the fifth floor of the Nashua Gummed and Coated Paper Company plant in Nashua, N. H., at 9:45 P.M. on January 5th, 32 operating automatic sprinklers practically extinguished flames issuing from a fast spreading fire involving paper plugs stored in burlap bags *except* in two relatively small areas. In these latter sections, effective sprinkler discharges were hampered by steel reinforcing beams at the ceiling and by 12-in. ventilating ductwork. The fire department entered the structure with three large capacity hose lines, but could not make effective use of them because of dense smoke and the congested storage conditions encountered. It was not until three hours later that a large hose line was successfully employed through a window and the "all out" signal was not sounded for two more hours. Sprinklers operated from 9:45 P.M. until 1:40 A.M. While damage to the building was slight, enormous quantities of water poured down through all floors below the fifth, causing severe damage to large storages of finished paper products, machinery, equipment, motors, electric wiring and conduit, and other supplies. Only effective plant salvage work reduced the loss to about $50,000. Subsequent to the fire, the ductwork has been lowered so that one line of heads will throw over and additional sprinklers have been added to assure proper distribution over the floor area.

Lack of Outside Sprinkler Protection

Certain sprinkler protected properties, particularly those of combustible construction, urgently need exterior sprinklers to protect against serious exposure fires. Not enough attention has been given to this subject in recent years and it is accordingly

well to provide a fire illustration in the 1948 record.

The Brunsene Canvas Coating Company plant in Watertown, Mass., has a yard storage of lacquer, thinner, and solvents which constitutes a serious exposure hazard to their sprinkler protected wooden building. On August 9th roofing contractors built a fire in the yard under a tar pot in the immediate vicinity of a number of full and empty barrels of lacquer and thinner. Escaping flammable vapors from these barrels ignited, and a very hot fire developed which communicated to the wood side walls of the plant and entered through ordinary glass windows. Fourteen sprinklers inside the building operated and succeeded in keeping the fire from entering the structure, but, naturally, could do little to stop the spread of fire along the exterior walls. Effective fire department action limited the damage, but the lack of exterior sprinklers obviously placed the entire structure in jeopardy.

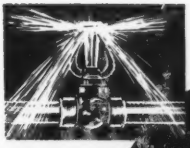
Floor Collapse Rupturing Piping

One of the more unusual fires in sprinklered buildings reported during 1948 occurred on March 16th in a 96-year-old tenant occupied manufacturing and storage building in Manchester, N. H. Overloading of the fourth floor with an excessive amount of flour caused structural collapse of two bays on this and the third floor, plus a small section of the exterior brick wall at one corner of the structure. Fire broke out and the public fire department responded to an alarm given by employees. Sprinkler pipes were sheared off on each of the two floors and the fire gained great headway in the deep pile of fallen stock, requiring six hours of manual fire fighting before control could be established. Sprinklers on the fourth story remained intact and operated as long as water was supplied, but could hardly be effective under the circumstances.

Conclusions

This review of fires in sprinklered properties should inspire renewed energies to maintain and improve the record of efficiency which this type of protection has maintained during the past 50 years. There is work to be done and some of the suggestions offered here are indicative of this fact. Our country needs continuity of production, conservation of all her material resources, and every living disciple of the American way of life on whom God will grant his patient benevolence. It is no exaggeration to say that automatic sprinklers are the most positive means in the hands of fire protection engineers to guarantee this security to our people. Let us keep it that way by attacking every vulnerable spot which might compromise their essential function.

The automatic sprinkler industry is conscious of its obligation to the public and to the insurance organizations which pay the fire losses. Through fact-finding and other technical committees, we are developing ways and means of controlling the increasing hazards of modern industry. We desire the cooperation and constructive criticism of everyone interested in safeguarding life and property.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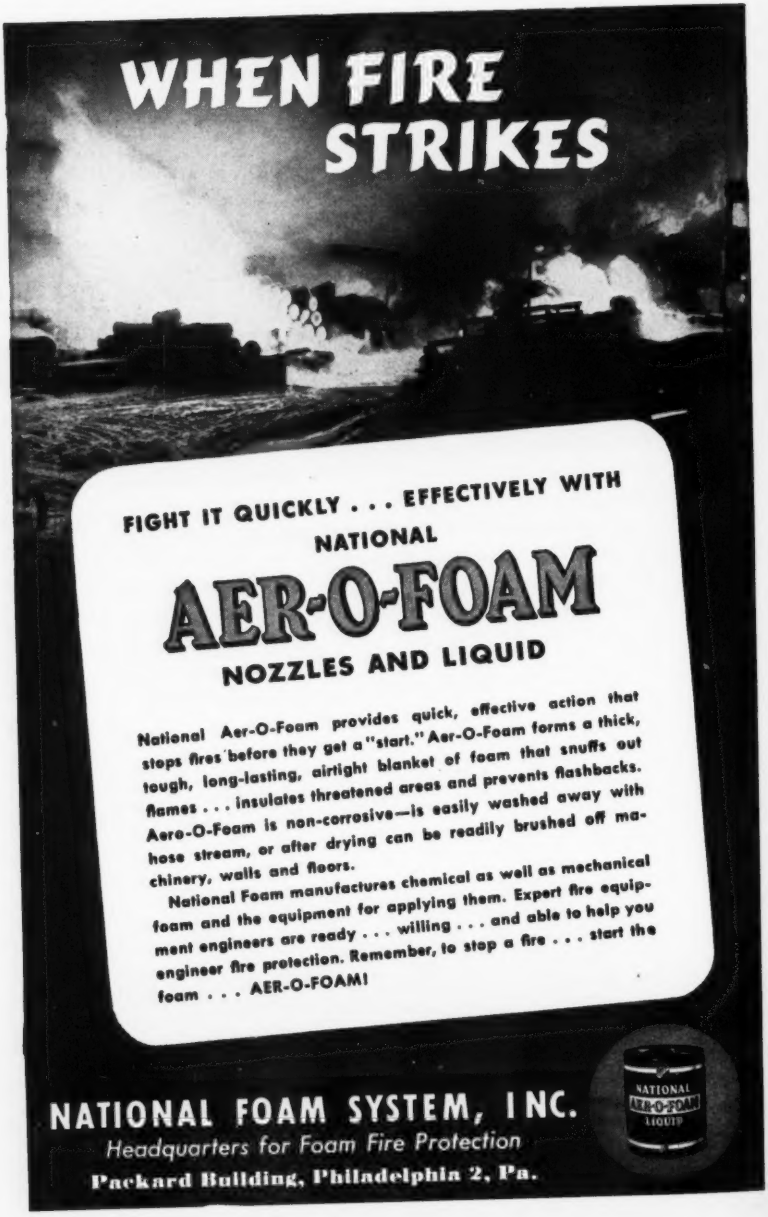
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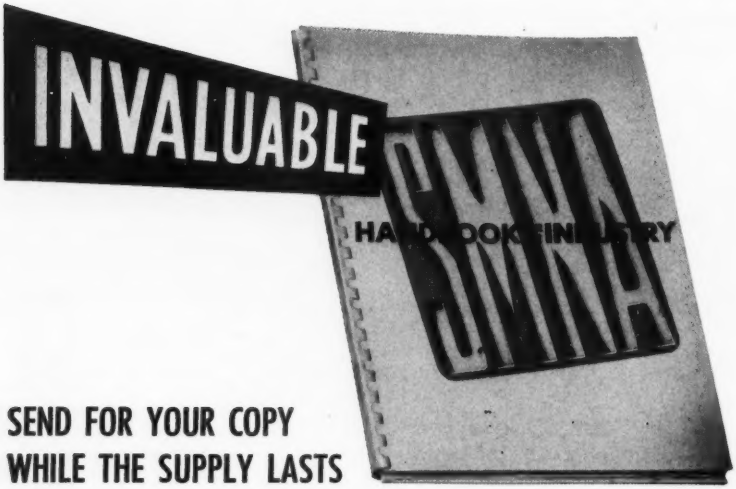

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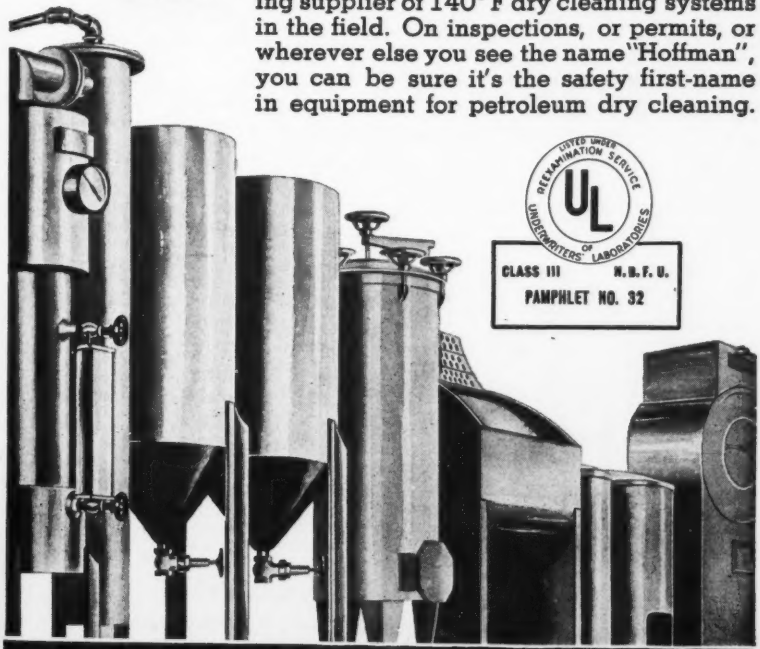

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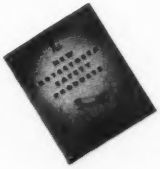

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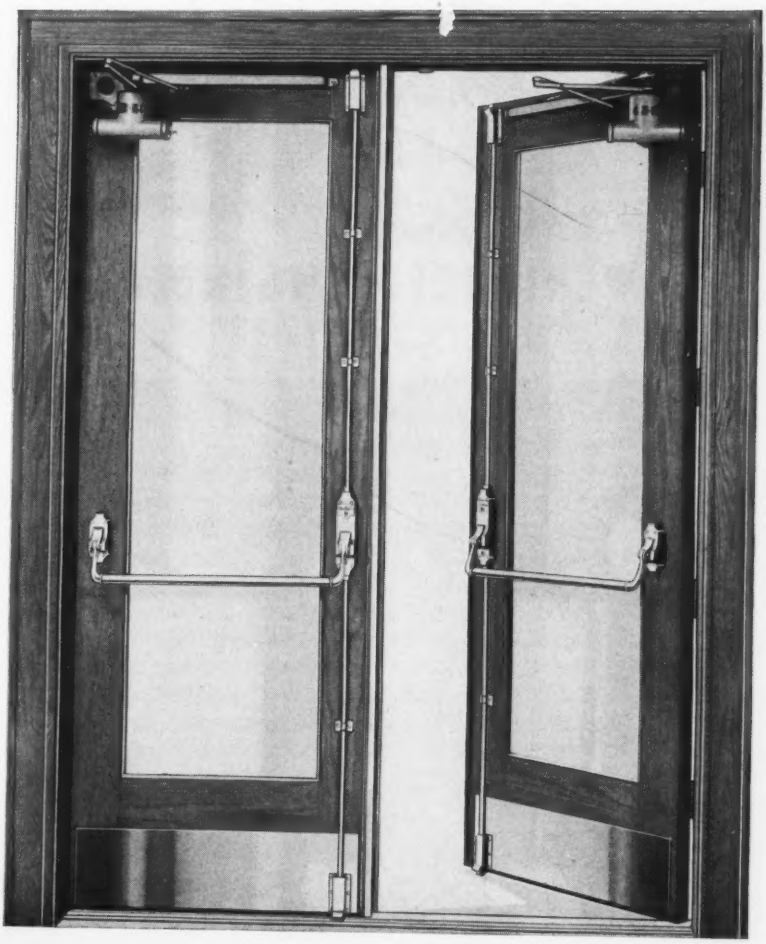

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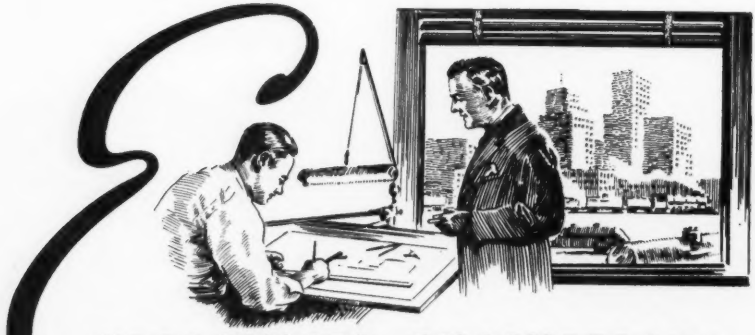

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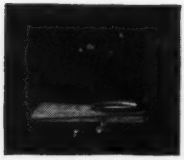
NEW YORK..Room 950, 270 Broadway
CHICAGO.1272 First Nat'l Bank Bldg.
DES MOINES.....969 Tuttle Street
DALLAS.....1273 Praetorian Bldg.
SEATTLE.....976 Lane Street
SANTA CLARA, CAL..675 Alviso Road

200,000-gal. Double Ellipsoidal Tank on 125 ft. tower. Columbia Steel Co.

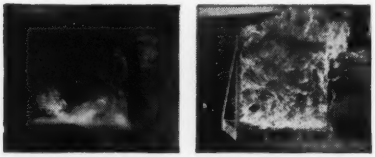
100,000-gal. Hemispherical bottom tank on 116 ft. tower. Crosley Radio Corp.

100,000-gal. Hemi-ellipsoidal bottom tank on 44 ft. tower. El Paso Natural Gas Co.

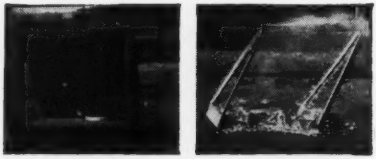
TESTS CONFIRM...



Test structures built of Koppers fire-retardant wood (left) and untreated wood (right) ready for the fire test. Five quarts of kerosene, placed in pans, furnishes fuel for each blaze.



Both structures are quickly enveloped in flame. Treated structure resists fire, but untreated one encourages it, contributes fuel to the fire.



After twenty-two minutes the untreated structure, still burning, is collapsing. Note that in the treated structure, the fire stopped when the fuel burned out.

KOPPERS

KOPPERS PRESSURE-TREATED WOOD

KOPPERS COMPANY, INC.
PITTSBURGH 19, PA.

fire retardance of KOPPERS CZC(FR)

Koppers fire-retardant wood is suitable for use as flooring, roofing, sheathing and structural members of industrial buildings, garages, airplane hangars, munitions plants, docks and warehouse buildings, railroad engine houses, and other similar structures. Koppers CZC(FR) treatment has a valuable plus advantage, for it also fortifies the wood against decay and termite attack. Color and paintability are not harmed by the odorless CZC(FR) treatment.

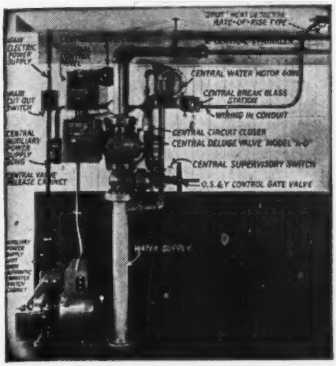
Investigate the possibilities of this new Koppers development. Send for your copy of the booklet, "Koppers Fire-Retardant Wood." Filled with interesting, helpful information.

Right · The treated structure was charred . . . but retained its integrity and strength, as the 800 pound load shows.

Left · Continued burning reduced the untreated structure to ashes.

There is always the One Best

Central "Electro-Speed" Deluge Sprinkler System Model "AD"



Completely Electrically Operated

• • •

Rate of Rise and Fixed Temperature Controlled

• • •

Fully Supervised

"A PRODUCT OF THE ELECTRONIC AGE"

Over six years ago we pioneered the first Underwriters approved electrically operated deluge type automatic sprinkler system. We now present, in the CENTRAL Model "AD" Electro-Speed Sprinkler System, a completely new and all electrically operated system, amazing in its simplicity of design and in its instantaneous super-speed electric operation.

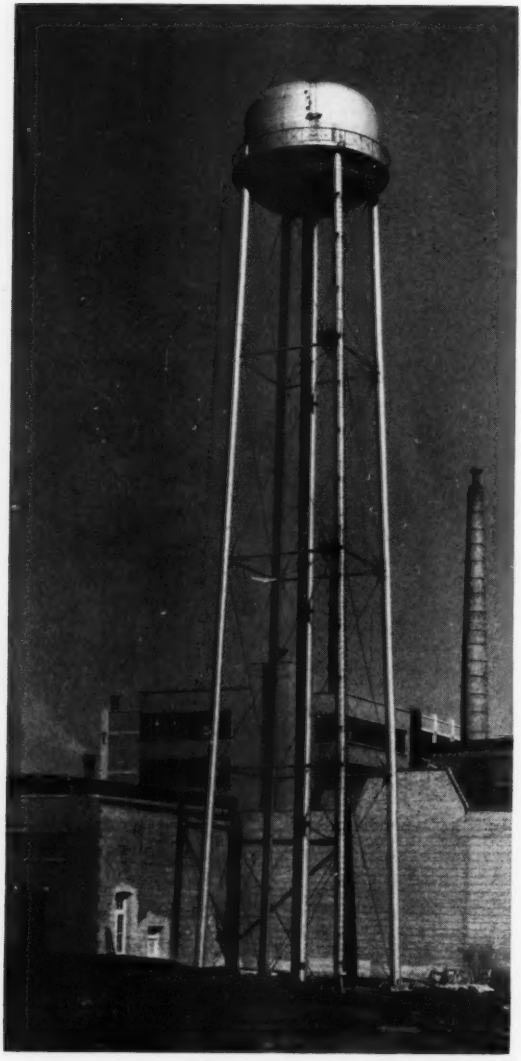
Every functional part is a standard product with years of dependable use to insure for you satisfactory and continued service.

Already approximately three hundred CENTRAL Model "AD" Deluge Sprinkler Systems are now in service protecting vital United States Army and Navy, and privately owned properties, and proving their superior design and operation over older types of deluge systems in adjacent buildings in some of these properties.

Send for illustrated and descriptive bulletin N.P.-V-4.

CENTRAL AUTOMATIC SPRINKLER CO.

FOURTH ST. & CANNON AVE. . . LANSDALE, PA.



PROVIDES DEPENDABLE FIRE PROTECTION

This 75,000-gal. elevated steel tank provides gravity water pressure in the automatic sprinkler system at the Chicago plant of the United States Tobacco Company. It is 150 ft. to the bottom. Welded construction was used throughout. Write our nearest office for estimates whenever you are making plans for fire protection installations.

CHICAGO BRIDGE & IRON COMPANY

CLEVELAND	CHICAGO	BIRMINGHAM	NEW YORK
HAVANA	DETROIT	ATLANTA	PHILADELPHIA
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Plants at Chicago, Birmingham, Salt Lake City and Greenville, Pa.

TRIPLE PROTECTION against FIRE

1. *Straight stream* can be discharged from the SG-48 Nozzle from small opening by a movement of the control handle, or

2. *High Velocity* WaterFOG with considerable forward projection from high velocity Fog tip, or

3. *Low Velocity* WaterFOG from LIGHTweight Extension Applicator. Fog tip is removed and Applicator inserted.

ROCKWOOD *LIGHTweight*

TRIPLE-ACTION TYPE SG48 WaterFOG NOZZLE

Here is a fire fighting tool that gives *triple-protection* against fires in ordinary combustibles and flammable liquids — Rockwood LIGHTweight Triple-Action SG-48 WaterFOG Nozzle.

This improved Rockwood WaterFOG Nozzle will control or extinguish fires faster with less water and will provide firemen with greater protection from fire, smoke and fumes. It also permits firemen to reach the very root of the fire and to attack it with less physical punishment. Available in ¾", 1", 1½" and 2½" sizes for service on fire hose lines. Designed and constructed for use in municipal fire departments, industrial plants, chemical plants, mercantile and public buildings, oil refineries, etc. Rockwood WaterFOG is approved by Underwriters' Laboratories, and Factory Mutual Laboratories.

Write for bulletin C-501R.

ROCKWOOD (Heavy Duty) APPLICATOR CLIPS

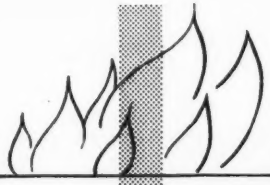
For mounting Rockwood WaterFOG Applicators and other Rockwood equipment on fire trucks, walls, posts, etc. Clips are chromium plated and are highly resistant to corrosion. Write for prices and further information today.

ROCKWOOD

ROCKWOOD SPRINKLER CO.

56 HARLOW STREET — WORCESTER 5, MASS.

Something's burning!



Is it a flammable liquid?

A PYRENE* Foam Extinguisher will knock it out—fast! Foam extinguishers are effective on ordinary combustibles, too. The 2½ gal. PYRENE Foam Extinguisher gives you about 22 gallons of quick-smothering foam. PYRENE Foam is also available in 10 and 40 gallon wheeled extinguishers and in systems. Flammable liquid fires can be snuffed out by PYRENE Vaporizing Liquid Extinguishers, as well.

Is it paper, rags, ordinary combustibles?

Bring out the PYRENE Cartridge-Operated Extinguishers! No pumping needed—the pressure in the gas cartridge is enough to shoot a stream 40 feet. No annual recharging. Water or anti-freeze types, 2½ gal. capacity. PYRENE Soda-Acid and Pump Tank Extinguishers are also recommended.

Is it electrical equipment?

Put PYRENE Vaporizing Liquid Extinguishers to work! The extinguisher liquid is non-conducting, fast-working, non-freezing in temperatures as low as −48°F. Also effective on flammable liquid fires and surface fires fed by ordinary combustibles. Pressure type in 2 qt. and 1 gal. sizes; pump type in 1 qt. and 1½ qt. sizes.

PYRENE also makes Air Foam Playpipes and systems for the smallest dip tank to the largest oil storage tank.

•

FREE! Send for leaflet "What You Should Know About Fire Extinguishers." Helpful for factory fire brigades.

PYRENE MANUFACTURING COMPANY

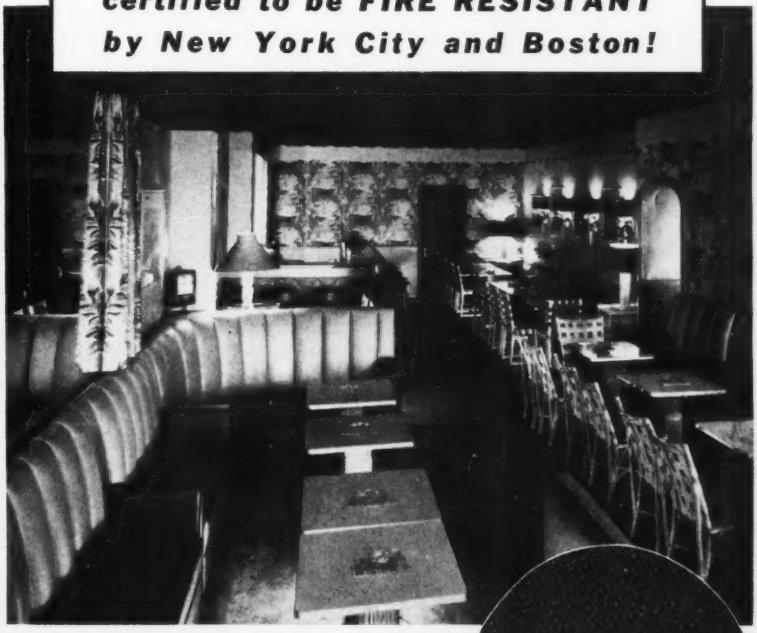
582 Belmont Avenue Newark 8, N. J.

Affiliated with C-O-Two Fire Equipment Company

Have You Tested Your Fire Extinguishers Lately?

TOLEX* UPHOLSTERY

certified to be FIRE RESISTANT by New York City and Boston!

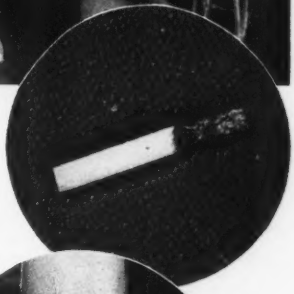


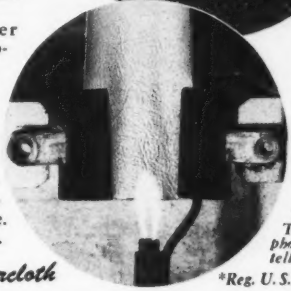
Among progressive cities, the trend is more and more toward flame-resistive requirements in furnishings for places of public gathering.

Today—New York City, Boston and other large cities have fire-resistant requirements for upholstery, wall coverings and interior decorations *which are met by TOLEX plastic leathercloth.*

TOLEX is a product of Textileather Corporation . . . pioneers in the development of fire-resistant upholstery leathercloth.

Consulting Service available to you!
We will gladly send our technical representative to discuss fire-resistant leathercloth specifications and test methods with fire marshals, fire departments, fire prevention boards or underwriters. There is no charge for this service. Write to Textileather Corp., Toledo, Ohio.





These TOLEX photographs tell the story

35 Years of Leadership in Leathercloth

*Reg. U. S. Pat. Off.

REGO
LP GAS EQUIPMENT

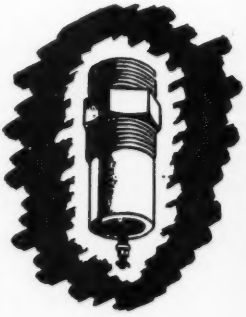
Specified For...

PERFORMANCE PLUS SAFETY!

Here's Why:

- It is listed by Underwriters' Laboratories
- It conforms to N.F.P.A. Standards
- It is manufactured only after thorough field testing
- It is shipped only after being rigidly inspected and tested at the factory

Typical of the many RegO-designed devices for insuring the safe use of LP Gases are RegO Excess Flow Check Valves. These valves, which shut off the flow of fuel should a break in the line occur, may be used with butane or propane in either a gaseous or liquid state. They function with complete efficiency whether mounted vertically or horizontally. A complete range of sizes provides valves suitable for every use, from small domestic installations to large bulk plant or industrial applications.



RegO Excess Flow Check Valves

REGO LP GAS EQUIPMENT

The BASTIAN-BLESSING Company

4201 West Peterson Avenue Chicago 30, Illinois

PIONEER AND LEADER IN THE DESIGN AND MANUFACTURE OF PRECISION EQUIPMENT FOR USING AND CONTROLLING LP GASES

UNLESS YOU HAVE "MONEY TO BURN" READ THIS . . .

Every year, more than 11,000 lives are lost by fire. Last year, property loss through fire reached a staggering total of more than $600,000,000.

Insurance can give you protection from financial loss through fire. But you need more than protection. You need fire prevention. Fire prevention can help you avoid property loss and—even more important—loss of human life.

The best possible fire prevention you can buy is a GENERAL QUICK AID FIRE GUARD, located within easy access of every possible fire hazard.

Unless you have plenty of money to burn, install plenty of QUICK AID FIRE GUARDS in your place of business, your car, your home. There are five different types of QUICK AID FIRE GUARDS—a right extinguisher for every fire hazard. Your GENERAL dealer will help you select proper extinguishing equipment—without obligation on your part. Look for his name under "Fire Extinguishers" in your classified telephone directory—or write direct.

GENERAL
QUICK AID
FIRE GUARD

THE GENERAL DETROIT CORP.

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THE GENERAL DETROIT CORP., CANADA, LTD.

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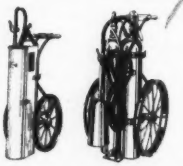
Think of C-O-TWO

TRADE MARK

REG. U.S. PAT. OFF.

FOR MODERN FIRE PROTECTION

C-O-TWO SQUEEZ-GRIP HAND PORTABLE FIRE EXTINGUISHERS. 2½, 5, 10, 15 and 20 pound sizes. Valve easily opened and closed . . . just squeeze to open . . . release to close.



C-O-TWO SQUEEZ-GRIP WHEELED PORTABLE FIRE EXTINGUISHERS. 50, 75, and 100 pound sizes. Sturdy, wide-faced wheels. With or without hose protection cover. Fast uncoiling, non-kinking, flexible hose.

QUICK – C-O-TWO is carbon dioxide gas . . . kills fire in seconds. Fastest and most efficient fire extinguishing agent known.

SAFE – C-O-TWO is non-damaging and non-conducting. Highly effective and entirely safe on flammable liquid and electrical fires. Harmless to metals, finishes and fabrics . . . even food.

CLEAN – C-O-TWO is clean, dry, odorless, inert gas. Snuffs out the fire, then disappears without a trace.

ECONOMICAL – C-O-TWO is non-contaminating, non-corrosive and non-deteriorating. Authorized recharging stations located in all principal cities.

APPROVED – C-O-TWO Fire Protection Equipment is approved by Underwriters' Laboratories, Inc., Factory Mutuals and Government Bureaus.

C-O-TWO makes a complete line of carbon dioxide fire extinguishing equipment . . . smoke and fire detecting equipment. Let an expert C-O-TWO Fire Protection Engineer advise you on your fire protection needs now, before fire strikes. Write today for complete information. Remember fire doesn't wait . . . act now!

C-O-TWO FIRE EQUIPMENT COMPANY

NEWARK 1 • NEW JERSEY

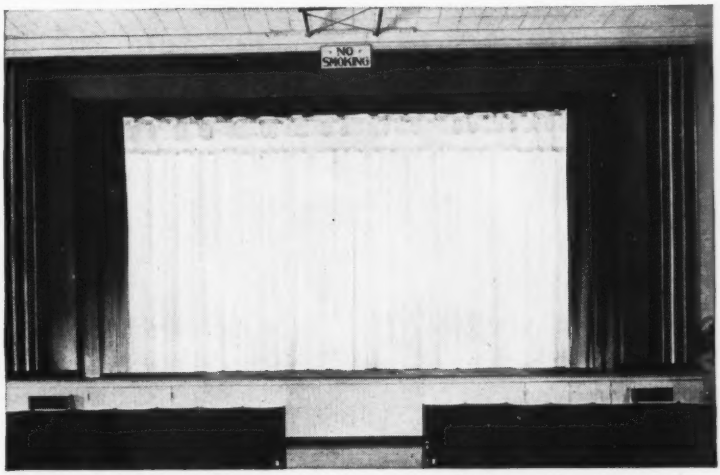
Sales and Service in the Principal Cities of United States and Canada

AFFILIATED WITH PYRENE MANUFACTURING COMPANY

C-O-TWO HOSE RACK AND HOSE REEL UNITS. 35 to 200 pound sizes . . . 25 to 100 foot hose lengths. Fast uncoiling, non-kinking, flexible hose.

C-O-TWO MANUAL AND AUTOMATIC FIRE EXTINGUISHING SYSTEMS. Designed to meet your particular needs. Can be used in conjunction with smoke and fire detecting systems.

C-O-TWO SMOKE AND FIRE DETECTING SYSTEMS. Designed to meet your particular needs. Can be used in conjunction with fire extinguishing systems.



Auditorium installation in Norfolk Naval Hospital, Portsmouth, Va. Proscenium curtain in plum satin stripe, cyclorama curtain in gold chevron Fiberglas. Installed by L. B. Sheffield, Richmond, Va.

These NON-COMBUSTIBLE curtains never require flameproofing!

At best, the flameproofing of combustible fabrics woven partly or wholly of organic fibers affords only temporary protection. Its efficiency depends upon the type of chemical used to flameproof the organic fibers, and the length of time since the last treatment.

Fiberglas* decorative fabrics are woven entirely of finely spun, inorganic glass filaments. They CANNOT BURN, smolder or propagate flame. If exposed to fire they will not deplete the oxygen in the air or emit suffocating smoke and fumes. They are immune to rot or decay. *Always operate at 100% efficiency.*

Installed in all ships of the U. S. Navy (Bureau of Ships Spec. 27c7).

CORONIZED* FIBERGLAS FABRICS

Coronizing is an entirely new process that gives Fiberglas fabrics greatly improved handling, draping and cleaning qualities. Also available in a marquisette curtain material that is permanently wrinkle-proof and water-repellent. May be hand or machine washed; requires no ironing, stretching or framing.

WRITE FOR SAMPLES AND INFORMATION

THORTEL
FIREPROOF FABRICS

FIBERGLAS* Listed by Underwriters' Laboratories, Inc., as "Non-Combustible Fabric"; approved by the Bureau of Standards and Appeals, City of New York.

ARCHITECTS BUILDING, 101 PARK AVENUE, NEW YORK 17, N. Y. • LExington 2-0711

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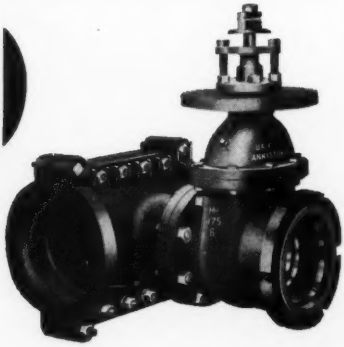
*T.M. Reg. U. S. Pat. Off. Owens-Corning Fiberglas Corp.



VALVES, HYDRANTS
Indicator Posts and
Pipe Fittings For
FIRE PROTECTION

We make a complete line of Valves, Hydrants, Indicator Posts and underground pipe fittings for fire protection systems. All M&H products are approved and listed by the Underwriters' Laboratories and A.F.M. Laboratories. Outstanding features are simplicity of design, rugged construction and highest quality materials and workmanship. Write for CATALOG No. 40. On your orders specify M&H for service.

Top, Left: Swing Check valve.

Above: Tapping Sleeve and valve to tap a main under pressure.

Right: Rising Stem Gate Valve, bronze mounted.

Below, Right: Mill Yard Hydrant, Independent Hose Gate Valves.

Left: Adjustable Indicator Post.

Right: All-bell Cast Iron Tee.

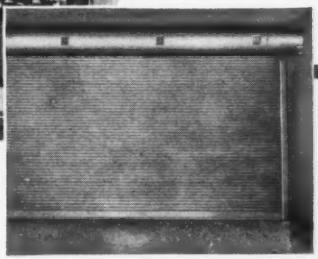
M&H VALVE
AND FITTINGS COMPANY
ANNISTON, ALABAMA

KINNEAR "AKBAR"

ROLLING FIRE DOORS

automatically block spread of flames

These dependable, positive-action doors combine modern styling and fire protection at this entrance to Penney's in the smart, new Terrace Plaza Hotel Building in Cincinnati.



Outstanding structures here and abroad rely on Kinnear "Akbar" Rolling Fire Doors for *automatic* fire protection. These all-steel, fireproof doors set up a "road block" against flame-spreading drafts. They *coil overhead* when not in use, but *promptly* seal off doorways, windows, and corridors at the threatening approach of fire. Positive closure is certain because Kinnear Rolling Fire Doors are *pushed* downward automatically by a strong auxiliary spring. They are *controlled* in downward speed by a special safety device, to avoid personal injury and to lessen floor impact. If raised after closure as an emergency exit, the doors are closed again automatically by the counterbalance spring.

Lack of fire-door protection has proved an important contributing factor to losses in major fires. Akbar Fire Doors are approved and labeled by Underwriters' Laboratories. In many cases these doors save enough in lower insurance rates to repay their cost in two or three years. Built to fit building openings of any size, they can be equipped for daily service use, with or without motor operation. When extra fire protection is not required, regular (non-labeled) Kinnear Rolling Doors are preferred for service use. Write for details.

THE KINNEAR MANUFACTURING COMPANY

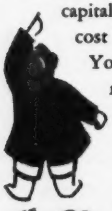
FACTORIES
2250-70 Fields Avenue, Columbus 16, Ohio
1742 Yosemite Ave., San Francisco 24, Calif.
Offices and Agents in Principal Cities

KINNEAR ROLLING DOORS

SAVING WAYS IN DOORWAYS

ARE you in a position to definitely measure the over-all cost of destruction, should fire reduce your plant or property to a shambles of twisted steel or broken concrete? We doubt it, for fire loss represents considerably more than is visible in the destruction of buildings, equipment and records. It means the interruption of production and service, the reduction of assets and increased liabilities. It means temporary and perhaps permanent loss of customers. In short, it could well mean the financial ruin of your entire business enterprise.

On the brighter side of this picture of fire destruction stand *"Automatic" Sprinklers*, industry's most effective weapon against fire. For, *"Automatic" Sprinkler* systems are super-sensitive to the very indication of flame. They make the fire extinguish itself, even before it can make headway. And, on the financial side, *"Automatic" Sprinklers*, like any other capital asset, can be amortized over a given period of years, with their initial cost ultimately taken as an operating expense.



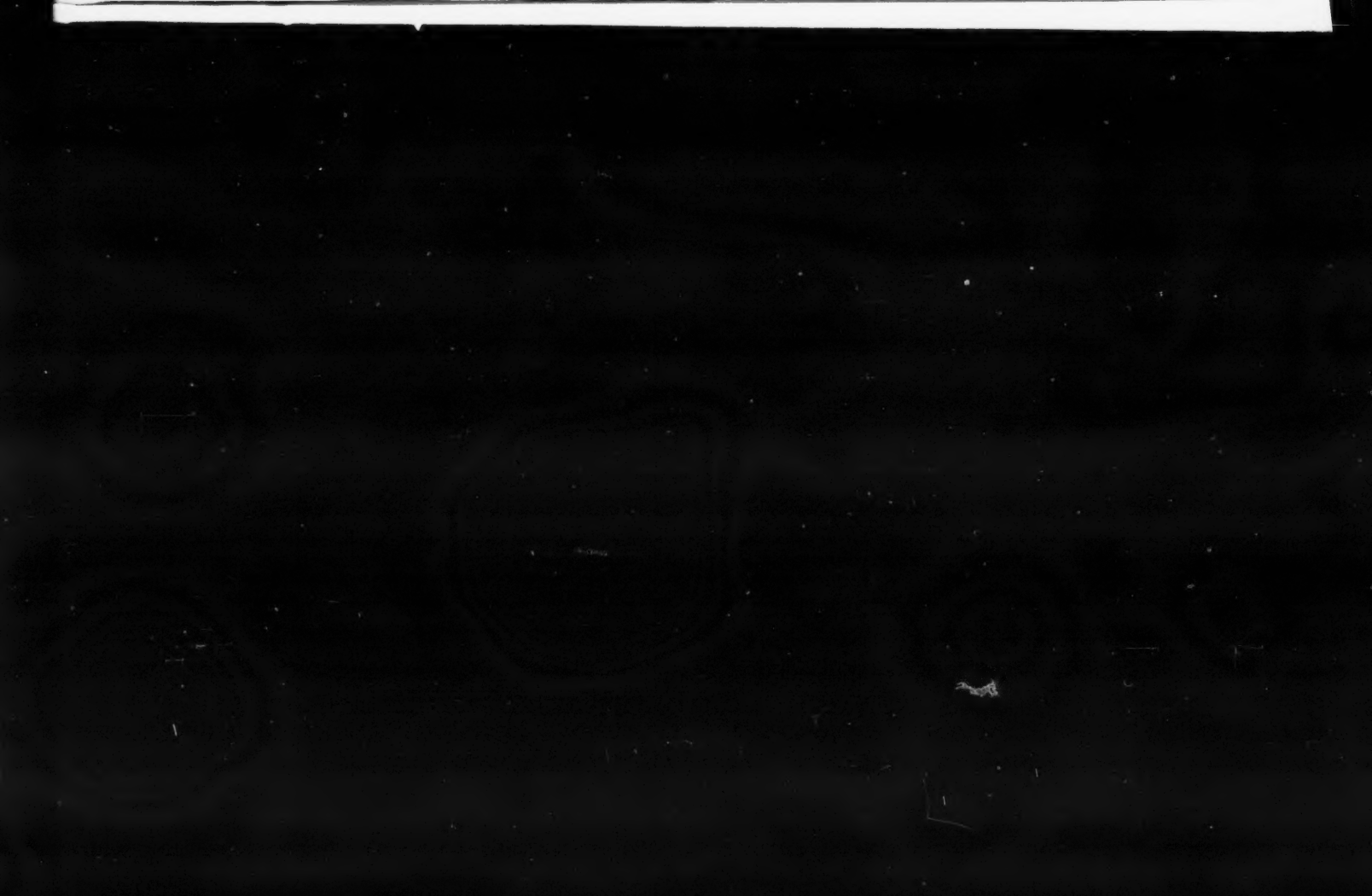
You and every other executive with an appreciation of business economy must not overlook the importance of fire safety with *"Automatic" Sprinklers*, *an important investment today . . . perhaps welcomed protection tomorrow.*

"Automatic" Sprinkler Corporation of America, Youngstown 1, Ohio, Offices in principal cities of North and South America.

"Automatic" Sprinkler

FOR INVESTMENT PROTECTION

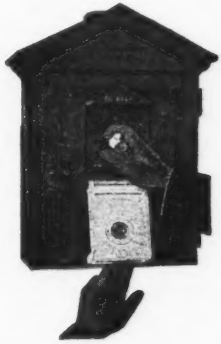
DEVELOPMENT · ENGINEERING MANUFACTURE · INSTALLATION



WHY CITIES PREFER GAMEWELL

2 Reasons are—Economy and Dependability

Many Gamewell fire alarm boxes still in use have service records exceeding 70 years, and — Obsolescence, due to the production of later models affording greater protection, not deterioration, is generally the cause of retiring Gamewell boxes from service.



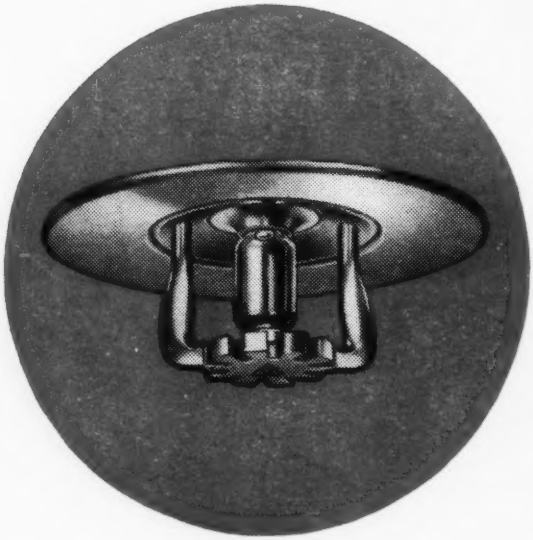
Gamewell Three-Fold Fire Alarm Box

The Standard for Municipal Service

For the protection of the values at risk — human life, property, business and income — adequate fire alarm box distribution is a sound investment.

THE GAMEWELL COMPANY

Newton Upper Falls 64 - Massachusetts

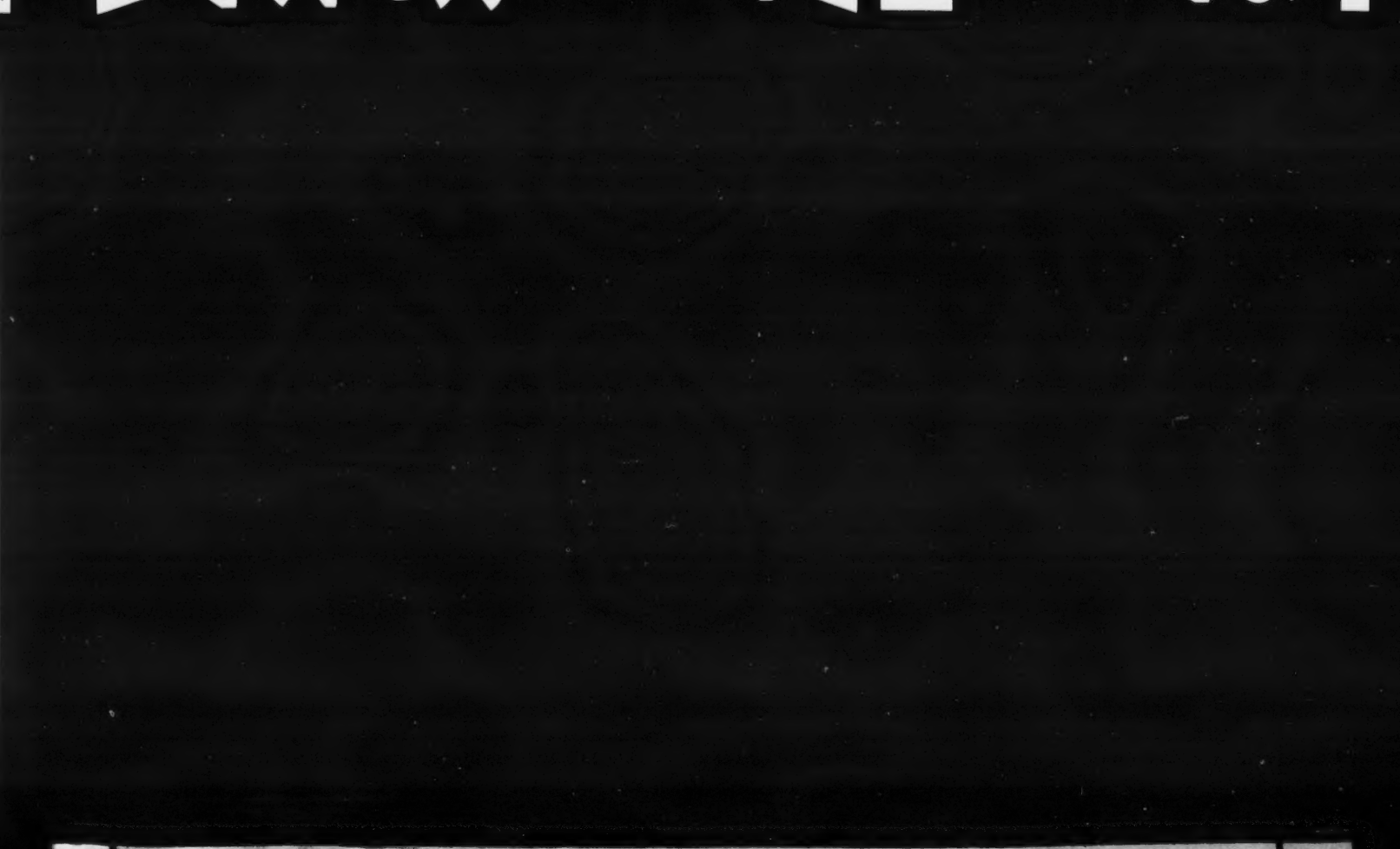


FIRE PROTECTION

where Appearance counts

The new Grinnell Quartzoid Ceiling Sprinkler combines full standard protection with almost unnoticeable appearance. This new head protrudes but 1″ below ceiling yet provides coverage for both ceiling and floor area. All piping is hidden above the plaster or acoustic panels. Quick operating protection — opens at 135°.

Complete information is available for the asking from any of our offices throughout the country. Grinnell Company, Inc., Providence 1, R. I.

GRINNELL SYSTEMS

Protection Against Fire